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VOLUME XX | DECEMBER 7, 1931 | Number 24

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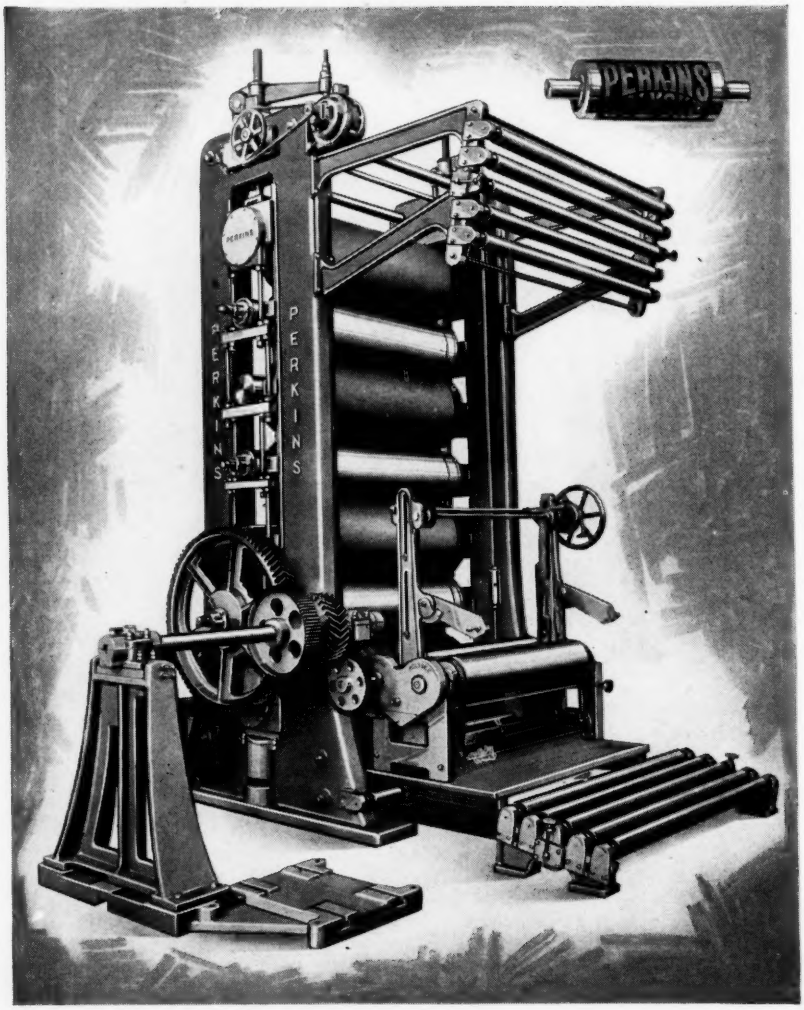

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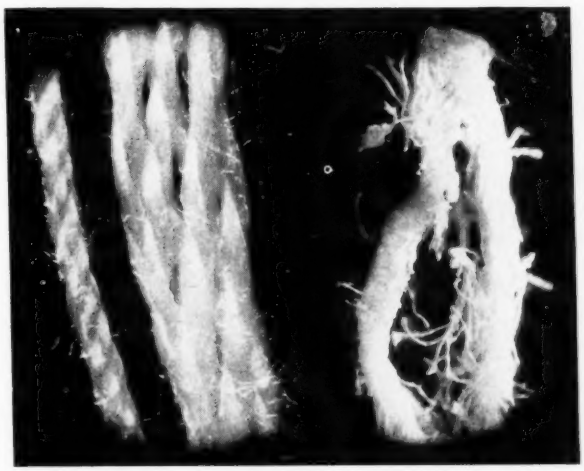
WHITENESS AND SOFTNESS



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VOLUME XX | DECEMBER 7, 1931 | NUMBER 24

New Wetting Agents—Sulphonated Abietenes*

By I. GUBELMANN, H. J. WEILAND, and C. O. HENKE

Research Laboratory, Dyestuffs Department, Newport Division, E. I. du Pont de Nemours & Company, Carrollville, Wis.

A short history of the development and uses of the different types of wetting agents is given. The preparation, properties, and uses of new wetting agents—the sulphonated abietenes—are described.

WETTING agents are used in various textile-treating operations, such as dyeing, carbonizing, mercerizing, printing, and the like. They are usually used in small concentrations in relatively large volumes of water. Concentrations of about 1 per cent are often used and even in such low concentration the effect of the wetting agent on the treating liquor is very marked. It is generally considered that the action of wetting agents is due to the lowering of the surface tension of the liquid. This lower surface tension permits the liquid to flow into the pores and interstices of the fibers and thus brings the treating liquor in contact with all parts of the textile material being treated. As a result the finished product is obtained even and free of untreated spots. This relation between surface tension and the wetting out of textile materials is discussed by Hall[3].

The most important and the oldest type of wetting agents are the soaps. A more recent type is the sulphoricinates or sulphonated oils, such as Turkey-red oil. This latter group may be said to date back to 1877 when Turkey-red oils were first made on a large scale[5]. In a German patent[2] there is described the preparation of isopropyl naphthalenesulphonic acid which brings in the third type of wetting agents—the alkylated naphthalenesulphonic acids. These are represented in commerce by the Neomerpins, the Nekals, and others, and have been widely applied in textile-treating operations during the last ten years. For mercerization an entirely different type of wetting agent has been developed[8], an example of which is a mixture of phenol and methyl cyclohexanol. An extended review of the various known wetting agents is given by Mullin and others[6], and a shorter review is given by Landolt[4].

Recently a new type of wetting agent has been brought out which is abietenesulphonic acid. Abietic acid, on thermal decomposition, splits off carbon dioxide, giving a hydrocarbon oil—abietene. Abietene may be readily sulphonated at low temperatures, using 100% sulphuric acid to give abietenesulphonic acid. The formula for this compound is not known, since it is derived from abietic acid, the formula of which is questionable. Also the reaction involved in making abietene from abietic acid is not fully understood[7]. It is quite certain, however, that abietene is a partly hydrogenated three-ring compound, and that it has one isopropyl group and at least one methyl group. Instead of using pure abietic acid, which would be quite prohibitive commercially, it has been found that rosin can be used for the production of abietene. This gives an abundant and cheap source of raw material, thus permitting the production of this new wetting agent in large quantity at an attractive price.

Properties

The abietene as it is produced from FF grade wood rosin by thermal decomposition has a specific gravity of about 0.99 at 15° C., distils mostly at about 340° to 350° C., and contains less than 1 per cent abietic acid. It is preferably sulphonated by being run slowly into twice its weight of 100 per cent sulphuric acid at about 10° C. and stirring at this temperature for 20 hours. The sulphona-

* Presented before the Division of Dye Chemistry at the 82nd Meeting of the American Chemical Society, Buffalo, N. Y., August 31 to September 4, 1931. Published through courtesy of Jour. Ind. and Eng. Chem.

tion mass is then run into such an amount of water that the final concentration of sulphuric acid is of about 40 per cent strength, whereby the sulphonic acid separates as a black oily upper layer. After separating the sulphuric acid layer, the sulphonic acid layer is dissolved in water, neutralized with an alkali, and filtered. The filtrate is evaporated and the product pulverized.

The abietenesulphonic acid is a black paste, soluble in water in all proportions. Its alkali metal salts are solids and are readily powdered. They are stable compounds, are not hygroscopic, and may be kept indefinitely. The ammonium and pyridine salts may likewise be made and are also found to be good wetting agents. The product is produced commercially in the form of its sodium salt and is a tannish colored powder. It may be used in neutral, alkaline, or acid solutions. Concentrated solutions of acids or salts, however, salt it out.

The newer wetting agents have not displaced the older ones except to a limited extent, but have broadened their field of usefulness. Thus, while the soaps can be used in only neutral or slightly alkaline solutions, the abietenesulphonates and the alkylated naphthalenesulphonates can be used in both acid and slightly alkaline as well as in neutral solutions.

Methods of Testing Wetting Agents

Various methods have been used for testing wetting agents. A simple test is to determine the number of seconds required for a 1-inch square piece of No. 6 canvas to sink in a 1 per cent solution of the wetting agent at 22° to 23° C. Another method is that described by Draves[1], in which a 5-gram skein of cotton yarn is used. Although these simple sinking tests give an index of the properties of a wetting agent, they are not conclusive and do not give a full picture of their value in treating baths. This is true since so-called wetting agents usually have other properties besides their wetting properties, and in some cases these other properties may be of much greater importance than their wetting properties. A conspicuous and common example of this is soap. The actual value of a wetting agent does not depend solely upon the speed of wetting but on the total of all its properties which may be useful in the operation in which it is to be used. This can only be determined by practical and systematic trials in the operation in which it is used. Thus the simple sinking tests showed that the sodium isopropyl naphthalenesulphonate has a greater speed of wetting than the sodium abietenesulphonate. However, when 10 per cent dyeings of Anthrene Violet BN 25 per cent paste were made on skeins of cotton yarn wetted in the same way with the two materials, the one wetted with the sodium abietenesulphonate gave the stronger and more level dyeings. Likewise, on adding the agent directly to the dye bath and then dyeing untreated cotton yarn, the dye bath containing the sodium abietenesulphonate gave stronger and more level dyeings than the one containing the sodium isopropyl naphthalenesulphonate. This is probably because of the excellent penetrating and dispersing properties of the sodium abietenesulphonate. These are not measured in a simple sinking test, but slow up in the practical results secured when it is used.

If 50 parts of sodium abietenesulphonate, 15 parts of water, and 35 parts of terpineol are thoroughly mixed together and warmed, a clear homogeneous solution is secured. This mixture is a liquid above about 30° to 35° C. and is easily handled at this temperature, but is somewhat viscous at lower temperatures. This mixture has much better wetting properties, as measured by sinking tests, than the sodium abietenesulphonate itself. In actual dyeing tests it gave stronger and more level dyeings than any of the other wetting agents that have heretofore been available.

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[2]German Patent 336,558 (Oct. 23, 1917).
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[7]Ruzicka, *Helv. Chim. Acta*, 6, 833-46 (1923).
[8]Tagliani, U. S. Patent 1,776,052 (Sept. 16, 1930).

General Release

The General Dyestuff Corporation is sending out a circular on Indanthren Brilliant Pink BBL Powder fine for dyeing which is claimed to represent a new homogeneous dyestuff of excellent fastness to light and chlorine. In shade and fastness properties the new dyestuff is near to the well-known Indanthren Pink B which it is said to very considerably surpass in clearness and brightness.

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New Location

The New York Laboratories of the U. S. Testing Co., formerly at 316 Hudson Street, are now established in their own building at 1415 Park Avenue, Hoboken, New Jersey. They will maintain an office in Room 915 in the Flatiron Building.

Theoretical and Applied Silk-Soaking

By **RALPH HART**
Hart Products Co.

Research work on silk-soaking, as on other phases dealing with silk and silk-processing, had been neglected for a long time. In the "Report of the Progress of Applied Chemistry" for 1930, issued by the Society of Chemical Industry, it is stated that: "The neglect of silk as a subject for research by chemists, to which reference was made in last year's Report, has been remedied by T. B. Johnson and his collaborators." Of the two articles mentioned in that report, one is on silk-soaking by G. W. Searell and the writer, representing the cooperative efforts of the laboratories of Kahn and Feldman, Inc., throwsters and silk merchants, and the Hart Products Company, manufacturers of textile-chemical specialties. Other important articles on silk-soaking and backwinding have since then appeared in technical as well as in trade journals, and in the present discussion of the subject these publications have been freely consulted.

THE functions of soaking are (a) to facilitate the various throwing operations, and (b) to cause the silk to absorb water more readily and uniformly before knitting. The ultimate purpose, of course, is to increase production and improve the quality of the finished fabric, particularly its uniformity. Water appears to be the most important ingredient in the soaking bath, serving not only to soften the liaisons, reel markings, and gum tacks on the raw silk, which hold the threads together, but also to plasticize the silk gum, rendering it more ductile and non-elastic. The improvements effected by the water treatment are better winding of the yarn with fewer breaks in winding and in twisting, better setting the twist, and less tendency to kink. Again, in conditioning thrown yarn intended for knitting, the water imparts to the silk the necessary pliability for uniform stitching.

In order for the water to accomplish its purpose more effectively, certain ingredients are added to the soaking liquor, such as soaps and alkalies, to promote penetration and to obtain plasticizing and softening effects; hygroscopic materials and surface-reducing agents, to retain moisture and to cause rapid wetting-out before knitting; and substances to prevent mildew, decomposition, and oxidation, which are liable to develop when damp silk in the gum is allowed to stand too long. In addition to these, a certain amount of lubricating and softening oil is required to reduce the wear on the machines and prevent fuzzing of the silk, by the proper oiling of the surface of the thread. To a limited extent the oil may also help to soften the yarn and to prevent the soaked silk when dry from reverting to its original harsh and stiff conditions. By reducing friction, the lubricant serves further to diminish static electricity. A more detailed description of the effects upon silk of the various ingredients used in the soaking process, particularly as applied to the hosiery trade, will be discussed.

Water of Hydration and Swelling

When raw silk is soaked in water, according to Neville and Marshall, the sericin becomes hydrated—i.e., each particle of the gum is surrounded by a compressed shell of water, the force being due to secondary valences. Water of hydration or absorbed water cannot be expelled by pressure or other mechanical means. Furthermore, absorbed water occupies less space than free water, since it is in a compressed state, and hence the course of hydration may be followed by noting the contraction in volume when raw silk and water are brought together. This is conveniently carried out in a contrivance known as a dilatometer, which consists simply of a bottle with a carefully calibrated tube fixed in the stopper. Enough liquor is added to the silk in the bottle to bring the former within the graduations on the tube, and changes in the water level then correspond to changes in volume of the system. Neville and Marshall further found that hydration decreases with the alkalinity of pH, though sulphonated oils, which have a lower pH than water, showed less hydration. They also found that hydration is greater the lower the temperature, and that it is apparently complete after five hours' soaking at 38.7° C. (100° F.) Bacterial or enzymic action on the sericin was indicated by the impairment or even total loss of the power of hydration. In a similar manner it was also shown that soap and certain dyes used for tinting silk act antiseptically. Evidently some very interesting information is obtainable from a study of this new method of investigation by hydration.

A distinction must be made between water of hydration and water due to swelling. In the latter case the water is simply absorbed in the network of the swelled or extended colloid, and may be more or less removed by pressure, centrifuging, etc. According to Proctor and Wilson, swelling is due to the removal by the colloid (sericin) of one of the ions from the solution, and the attempt of the free ion to escape from the vicinity of the colloid holding the other ion. This attempt, which is due to osmotic or diffusion pressure, causes a stretching and expansion in volume of the network, or swelling. Swelling is made evident by the increase in weight and volume of the extended colloid, and is at a minimum at the isoelectric point of sericin or at a pH of about 3.9;

hydration, on the other hand, is then at its maximum. That swelling of raw silk is enhanced by alkalies is a matter of common knowledge and it is of considerable importance in the treatment of silk, for progressive swelling ultimately leads to complete solution of the gum. The following experiment illustrates the effect of alkalinity and swelling upon raw silk during soaking. Three soakings were made under the same conditions and with the same ingredients. In the first soaking, the original acid sulphonated oil was used; in the second, the oil was just neutralized; and in the third, an excess of 0.5% caustic soda was added. Upon centrifuging the skeins, all at the same time and in the same centrifuge, the take-ups in liquor were found to be 92, 116, and 180%, respectively, based on the weight of the bone-dry silk.

The quantity of water in relation to the silk varies widely in practice. It may be as low as 25 gallons per 100 pounds of silk and as high as 100 gallons, with the average of about 80 gallons. Laboratory experiments indicate that it takes approximately four times as much water as bone-dry silk to just cover it. This is equivalent to about 45 gallons of water to 100 pounds of silk. The use of soft water in soaking is taken for granted, since otherwise the hardness, in combination with the soaking ingredients, would form slimy deposits, besides interfering with the penetrating properties of the solution. The usual temperature of soaking is between 85° and 100° F., though for hard-natured silk a temperature as high as 120° F. has been recommended. In such cases, however, the alkalinity of the bath and the time of soaking must be carefully controlled. Soaking without water, using only oil, has also been proposed. Although the threads would undoubtedly be well lubricated, it is questionable whether the proper softening of the gum spots and plasticizing of the yarn could thus be attained.

Action of Soap and Alkali

Snell and Kimball state that the action of soap in the soaking bath has been found to be more complex than was originally thought. According to Hart and Searell, the soap loses to the silk part of its alkali, liberating the corresponding amount of free fatty acids, and at the same time there is a drop in the surface tension or penetrating ability of the solution. The reaction seems to be in the nature of a combination between the silk sericin and the alkali. The liberated fatty acids remain partly in the bath as an emulsion or suspension, and the rest is deposited upon the silk fibers. Raw Japan silk seems capable of decomposing in this manner about 6% of its own weight of soap, or approximately 30% by weight of the actual gum. Raw silk also adsorbs alkali in forms other than soap, such as caustic soda, or potash, carbonates, borates, phosphates, etc. Consequently, there is always a drop in the pH of the bath after soaking in an alkaline medium—i.e., above a pH of 7.0. On the other hand, there is an increase in pH upon soaking in an acid medium, such as straight sulphonated oil. In that case, the sericin, because of its amphoteric nature, is capable of adsorbing free fatty acids and rendering the liquor less acidic.

Snell and Kimball find no improvement in the pliability and workability of tram yarn beyond adding sufficient soap to facilitate wetting of the silk. Therefore, they believe that soap acts primarily as a penetrant and emulsifier for the oil, although adsorbed soap, because of its unctuousness, may also act to a limited extent as a lubricant, and through its ability to attract moisture, as a softener. E. N. Ditton is of the opinion, as a result of some tests conducted at the mills of the Gotham Silk Hosiery Company, Inc., in conjunction with Proctor & Gamble, that soap in the soaking bath has a very marked beneficial effect on the hygroscopicity of silk. The view that soap acts as a lubricant and softener to a limited extent only is substantiated in practice by the fact that yarn soaked in sulphonated oils, in which the soap content is negligible, is usually preferred to soap and oil by the trade in all cases where pliability and uniformity of construction are most essential. However, an increase in plasticity is found upon adding alkali, up to a maximum effect at a pH of about 10. Added in limited quantities, alkali serves to neutralize the free fatty acids, to soften the silk, and to improve its hygroscopic properties; in excess, however, there is a tendency of the silk to become harsh. As has already been stated, alkali produces swelling of the sericin, and under certain conditions may even cause partial or complete solution of the gum. In practice, however, if soaking is properly conducted, the amount of degumming is negligible.

Neville and Marshall find that the most stable and uniform emulsion was obtained by adding slowly the oil to the soap solution and stirring vigorously. The optimum concentration was found to be about 0.25% of soap, which is also the most efficient concentration for detergency. The better softening effect noted at this concentration is attributed to the finer dispersion of the oil, and consequently to better adsorption of the emulsion by the silk. In soaking silk of medium nature with soap and oil, the proportion of the former used in practice was found to vary widely, that is, from 0.25 to 2.25% based on the weight of water, with the averaging about 1.0%; 3 to 8% based on the silk; and 25 to 80% based on the oil, with an average about 40%. A. A. Cook recommends about 3½ pounds of soap for 100 pounds of raw silk and considers larger amounts wasteful.

Saponifiable and Mineral Oils as Lubricants

As has already been mentioned, the purpose of introducing raw oil into the soaking liquor is primarily to lubricate the surface of the fiber. Its use, therefore, is to save undue wear of the parts of the machine in contact with the silk, to prevent fuzzing of the yarn, and by minimizing friction, reduce static electricity. Snell and Kimball found that by changing the concentrations of neatsfoot oil in the bath there was no difference in the effect on the plasticity of the tram. To a certain extent the lubricant may also exert an internal softening effect by enveloping the wet sericin particles with oil, thereby preventing the re-hardening of the silk gum and the stick-

(Continued on Page 807)

Proceedings of the American Association of Textile Chemists and Colorists

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SIXTY-NINTH RESEARCH COMMITTEE MEETING

THE Sixty-ninth meeting of the Research Committee of the American Association of Textile Chemists and Colorists was held at the Chemists' Club, New York City, Friday, November 6, 1931, at 3:15 P. M.

The following were present:—

Chairman, Prof. L. A. Olney
Wm. D. Appel
Ralph F. Culver
Harry R. Davies
Walter E. Hadley
Dr. Jos. F. X. Harold
B. L. Hathorne
Henry F. Herrmann
Dr. E. H. Killheffer
Wm. R. Moorhouse
Dr. Hans Myers
Dr. Donald H. Powers
Dr. R. E. Rupp
Walter S. Williams
Secretary, Alex. Morrison

The Chairman reported on a meeting of the Sub-Committee on Research, whose program depends on whether or not our Association will again receive a grant from the Textile Foundation, Inc. The Chairman was empowered to prepare a report of accomplishments of the Research Committee and to interview Mr. Franklin D. Hobbs, Chairman of the Textile Foundation, Inc., in order that he might present an official application for a further grant toward the work of the Research Committee.

The matter of printing a list of imported dyestuffs in the next Year Book discussed at the last meeting was again discussed and it was finally voted that this idea be abandoned.

A letter from Wm. L. Hanselman, a member with the Hookless Fastener Co., relative to tests for metal in fabrics to be rubberized, was presented, and this brought forth a general survey of the reports of the sub-committee on this matter, and Dr. Rupp, chairman of the committee, will ascertain if the committee has any further report for the next Year Book.

The Chairman reported on work on fulling being done at the Lowell Textile Institute by Mr. Ryberg for the sub-committee on Fastness Tests for Dyed Wool. The committee is endeavoring to adapt this work to the Launderometer.

B. L. Hathorne, chairman of the Rayon Sub-Committee, discussed at length the future program of his committee in connection with study of the variance of elongations and tensile strengths of rayons in producing uneven dyeing.

The Chairman and Wm. D. Appel reported on work being done by Mr. Smith, Research Associate at Washington, on the effect of metals in cotton cloth on its deterioration on exposure to light.

The Chairman expressed the importance of the various sub-committees being prepared to present at the Annual Meeting such portions of their work as might be ready for official adoption. Also, of having their reports ready for publication in the 1931 Year Book which will go to press as soon as possible after the Annual Meeting.

The meeting adjourned at 5:15 to meet next in Boston, December 4th.

Respectfully submitted,

ALEX. MORRISON,
Secretary.

SEVENTY-SIXTH COUNCIL MEETING

THE Seventy-sixth Council Meeting of the American Association of Textile Chemists and Colorists was held at the Chemists' Club, New York City, November 6, 1931, at 2:00 P. M.

The following were present:

President: P. J. Wood.

Treasurer: H. R. Davies.

Councilors: Ralph F. Culver, Wm. R. Moorhouse.

Councilors ex-officio: Henry F. Herrmann, representing Robert H. Gaede, Chairman, New York Section.

Past President E. H. Killheffer.

Prof. L. A. Olney, Chairman, Research Committee.

Secretary: Alex. Morrison.

Letters expressing regrets at inability to attend were received from Vice-Presidents William H. Cady and H. A. Barnes, and from Henry D. Grimes, Chairman, Northern New England Section.

The records of the last meeting were read and accepted.

The Secretary's balance sheet was read as follows and approved:—

November 4, 1931

Cash on Hand Oct. 15, 1931		$412.68
Receipts, Oct. 16 to Nov. 4, incl.:		
Applications, 12 @ $5.00		60.00
Dues, 1—1930		5.00
1—1931		5.00
1—1932		5.00
Year Book Sales, 3 @ $3.00		9.00
Reported Sales		2.50
		$499.18
Disbursements:		
Oct. 16, To Treasurer—Research Fund	$ 31.50	
Oct. 16, To Treasurer—General Fund	250.00	
Cash on Hand, Andover National Bank	209.68	
Cash on Hand	8.00	
		$499.18

The Treasurer's report was read as follows and approved:—

November 5, 1931

GENERAL FUND

Balance as reported Oct. 15, 1931	$5,638.46	
Cash received since Oct. 15, 1931	256.43	
	$5,894.89	
Expenditures since Oct. 15, 1931	84.16	
Balance		$5,810.73

RESEARCH FUND

Balance as reported Oct. 15, 1931	$3,566.06	
Cash received since Oct. 15, 1931	31.50	
	$3,597.56	
Expenditures since Oct. 15, 1931	738.66	
Balance		2,858.90
Balance		$8,669.63
Checking account—First Nat'l Bank	$988.42	
Savings account—First Nat'l Bank	7,681.21	
Balance	$8,669.63	

The following were elected to membership as of thirty days after the publication of their names, provided no objection to any are received by the secretary:—

Active:

Altwegg, Emil D.—747 Charlotte St., Pottstown, Pa. Boss dyer and bleacher, Century Beverly Corp., Pottstown, Pa.

Grimiaux, Joseph J.—22 Hobart Place, Garfield, N. J. General manager and supervisor, United Textile Print Works, Long Island, New York.

Hayes, Stuart J.—5 Park Pl., Ludlow, Mass. Chemist and bacteriologist, Ludlow Mfg. Asso., Ludlow, Mass.

Mullen, Leonard—R. R. No. 9, Rockford, Ill. Dyer, B. Z. B. Knitting Co., Rockford, Ill.

Phily, Auguste C.—436 E. 32nd St., Paterson, N. J. Boss dyer, International Dye & Print Works, 55 First Ave., Paterson, N. J.

Watson, George W.—P. O. Box 144, Hazlehurst, Miss. Salesman, United Chemical Products Corp., Jersey City, N. J.

The Treasurer was requested to prepare a budget for 1932 based on past years, to be presented at the next Annual Meeting.

The Committee on Amendments to and Changes in the Constitution reported, and these changes duly signed were received and ordered to be sent to the members to be voted to letter ballot at the Annual Meeting.

The report of this committee is as follows:

CHANGES AND AMENDMENTS TO CONSTITUTION
TO BE ACTED UPON AT ANNUAL MEETING, DEC. 5, 1931

ARTICLE III PARAGRAPH 3

Stop after the word "occupations" and leave out rest of the paragraph.

Insert after this a new paragraph as follows:—

"Students in technical institutions of established standing, who are following courses leading to entrance into the occupations mentioned for Active membership may become Student Members."

ARTICLE III PARAGRAPH 6 FIRST SENTENCE

Insert "Student" between "Junior" and "Associate."

ARTICLE III PARAGRAPH 6 LAST SENTENCE

Leave out "In lieu of the above, student applicants for Junior" and insert "Applicants for Student."

ARTICLE VI PARAGRAPH 1

Leave out "Annual dues shall be $5.00, but this amount" and insert "Annual dues for Active, Junior, and Associate members shall be $5.00. Annual dues for Student members shall be $2.50. These amounts."

ARTICLE VII SECOND SENTENCE TO READ AS FOLLOWS:—

Such members may, however, be restored by vote of the Council to the rights and privileges of the Association during the fiscal year in which they were suspended by full payment of the dues for that year, or during any future year by full payment of money due the Association at the time of the suspension plus payment of full dues for the year in which they seek reinstatement.

ARTICLE XV PARAGRAPH 4

Leave out "$1.00 per member" in both places where it appears and insert "$1.00 per Active, Junior and Associate member in good standing May 1st of last year."

ARTICLE XIX

Change title to "Local Student Section" and in all cases change the word "Junior" to "Student."

Leave out Paragraph 3.

Add paragraph.

"Student members automatically become Junior members November 1st following their termination of school."

The President appointed Walter H. Williams Chairman, Wm. H. Cady and Dr. Jos. F. X. Harold as prize paper committee to judge the papers appearing in the Proceedings during the past year and to select the four best and to report to the Annual Meeting.

A letter from A. R. Thompson, Jr., Secretary of the Piedmont Section, as Chairman for the committee appointed at the last meeting to define boundaries of the Southeastern Section was read and boundaries therein described adopted.

The Southeastern Section shall include central and southern Alabama and Georgia below latitude of 34° 30′ north, all of the states of Florida, Mississippi and Louisiana.

This will necessarily mean a change in the Piedmont and South Central sections' boundaries.

The Piedmont Section shall not include Virginia, North and South Carolina, and vicinity around Augusta, Georgia.

The South Central Section shall include Tennessee, southern Georgia and northern Alabama.

The President appointed the secretary, Prof. L. A. Olney and Treasurer H. R. Davies a committee to draw up suitable resolutions on the death of Dr. Samuel Wesley Stratton, late President of the U. S. Institute for Textile Research.

RESOLUTION ON THE DEATH OF DR. SAMUEL WESLEY STRATTON

Whereas, Dr. Samuel Wesley Stratton, President of the United States Institute for Textile Research, died October 18th, 1931,

And whereas, the United States Institute for Textile Research and the American Association of Textile Chemists and Colorists are allied in their aims and purposes,

Be it resolved, that the Council of the American Association of Textile Chemists and Colorists hereby expresses to the officers and members of the United States Institute for Textile Research, its sincere regrets at the loss of their accomplished and most distinguished first President.

And be it further resolved, that a copy of these resolutions be spread upon the records of the Council Meeting of the American Association of Textile Chemists and Colorists, and a copy sent to the Secretary of the United States Institute for Textile Research.

Signed [LOUIS A. OLNEY, HARRY R. DAVIES, ALEX. MORRISON]
Resolution Committee.

The President called the Council's attention to correspondence received by him in regard to more careful editing of papers and remarks in the Proceedings. He was empowered to take up this matter with local secretaries.

The President also called the Council's attention to correspondence from Dr. Robert E. Rose in connection with joining the International Federation of Societies of Chemists Dealing with Textile and Colored Materials. The President was empowered to get further information in regard to this.

Prof. L. A. Olney read correspondence between Dr. Paul Krais and himself in regard to financial aid to Dr. Krais and his colleagues. The correspondence was ordered placed on file.

The meeting adjourned at 3:15 P. M. to meet next in Boston, Friday, December 4, 1931.

Respectfully submitted,

ALEX. MORRISON,
Secretary.

FALL MEETING OF MID-WEST SECTION

THE Fall meeting of the Mid-West Section of the American Association of Textile Chemists and Colorists was held October 24th, at eight o'clock, at the Bismarck Hotel, Chicago, Illinois, preceded by an informal dinner.

Following the regular routine business, election of officers for 1932 took place. The nominating committee, appointed by Mr. E. W. Morgan, Chairman of the Mid-West Section, was as follows: E. F. Hempel, chairman of the committee, Carl Braun, E. Smith, J. F. Feit, and L. Mullens. The nominees selected and unanimously voted into office were:

Mr. Edward W. Morgan—Chairman.
Mr. Clarence Wille—Vice-Chairman.
Mr. Arthur T. Brainerd—Treasurer.
Mr. William Bergh, Jr.—Secretary.

The meeting was then addressed by Dr. James A. Branegan, who gave an interesting talk on "Taking the 'Mystery' Out of 'Chem-Mystery'." The meeting adjourned at 10:30 o'clock.

Respectfully submitted,
WILLIAM BERGH, JR.,
Secretary.

Taking the "Mystery" out of "Chem-Mystery"

***By* JAMES A. BRANEGAN**
President, Kali Manufacturing Company

MR. CHAIRMAN and Members of the American Association of Textile Chemists and Colorists: The subject of my talk tonight, "Taking the 'Mystery' Out of 'Chem-mystery'," is one to which I have given much thought. The technical man who ranks high in his profession has usually spent 5 to 7 years at college. He has acquired a vernacular, a method of expression that certainly confuses the industrial worker and leads him to believe that in order to understand the theories of the upper strata of chemistry, one must have a supermind. All this tends to make chemistry mysterious and it is my object this evening to remove all this mystery business from this fascinating science.

Everybody is a chemist, even the cook. In fact, all chemical operations are performed in a up-to-date kitchen. Likewise, all industries have need of some knowledge of chemistry today.

DEFINITION OF CHEMISTRY

Ques.: What is chemistry?

Ans.: Chemistry is the study of the elements and their compounds and the forming of new combinations by chemical reactions.

Ques.: What is an element?

Ans.: It is not so long ago when most people considered fire, water and air as elements. This is incorrect, as fire is chemical action, water is a chemical compound and air is a mixture of elements. An element itself is the simplest form of matter—iron—copper—hydrogen—oxygen—sulphur—nitrogen—gold—silver—bronze—chlorine—iodine—lime—etc. These are all elements and there are 92 in all.

When I first started to study chemistry, we had only about 75 and now all have been discovered. The rare elements are usually found in rocks, or in sands, or earths where they were never suspected. Several years ago your great University at Illinois made one of the latest discoveries of one of these elements which is called "Illinium" in honor of the great State of Illinois. The larger number of the elements have no particular use as yet, but later some particular purpose may be worked out for them.

Mendeleeff, a Russian chemist, discovered the periodic law. By this law he found that the elements could be lined up so their variations in color, gravity, chemical reactions, electric conductivity, etc., etc., followed each other in a regular systematic variation. For instance, Lithium has an atomic weight of 7. It is a soft silvery metal and has certain chemical properties; add on 16 which is 23, and we have sodium, which is slightly different than Lithium. Add the weight of 16 to that and we have potassium which is slightly different than sodium, and, of course, very different from Lithium. By arranging the elements in this manner, we were able to fill in the gaps and predict those unknown at that time.

Ques.: What is a compound?

Ans.: A compound is made up of two or more elements joined together—water—copper oxide—Glauber's salt—methyl orange and all dyestuffs—vitriol—etc., etc. These are all compounds.

Ques.: How are these compounds formed?

Ans.: The answer to this question is extremely simple and if you will concentrate on this answer you will at

once understand how little mystery there is in "Chem-mystery." All the elements have the power of combining with other elements in definite proportions. This we call valence.

I have here a set of child's blocks and I also have some blocks which represent the elements. You have seen the look of concentration on a child's face as he tries to build a new house or pattern from building blocks, and just as these child's blocks go together and need concentration, so the atoms of chemistry go together by fixed rules and combine uniformly when the mind is concentrated on them. The product of the child's blocks is a new house, a new church, or a new figure, and you will notice the child's blocks are all joined together and there are no loose ends. So, in the chemical compound, the elements are joined together in definite proportions and there are likewise no loose ends. The atoms have different combining powers; for instance, Oxygen has 2, while Hydrogen has 1. I have here a block representing Oxygen. You will notice it has two arms, or extensions, while the Hydrogen has one. We call this combining power valence. In order to form a chemical compound, each arm must join another arm. It is now easily seen that the only way this can happen with one Oxygen and two Hydrogen is to tie one Hydrogen to each side of the Oxygen. This being done we have made water, H_2O. (Demonstration with wooden molecules.)

Likewise, Peroxide of Hydrogen is made up of two atoms of Hydrogen and two Oxygen and joined together in the following manner. (Demonstration with molecular blocks.) All the elements exist as atoms which form molecules, and therefore, we will want to know something about the atoms and the molecules.

Atoms and Molecules

Ques.: What is an atom?

Ans.: An atom is the smallest particle into which an element can be divided. The single blocks shown here represent the atoms.

Ques.: What is a molecule?

Ans.: A molecule is two or more atoms combined together in the manner which I demonstrated to you a few moments ago. These molecules may consist of atoms of the same elements or of other elements, but they must be chemically joined together. The H_2O formation and the H_2O_2 formation of the blocks represented the molecules.

Divisions of Chemistry

Chemistry is divided into two great branches, Organic and Inorganic.

Organic chemistry is a study of carbon and its compounds and embraces such products as dyestuffs, foodstuffs, etc.

Inorganic chemistry is a study of the compounds which do not contain carbon, such as iron, hydrogen, oxygen, tin, lead, ammonia, caustic soda, various acids, etc.

The work of the Chemist is also divided and we have Synthetic, Analytic, Research, Electro, Biological, etc.

Ions

Molecules that dissociate in water are called ions. They are the electrolytes. They raise B. P. and lower F. P. of liquids greater than molecules which do not "fall apart" —i. e., they act as if the molecules were doubled. They differ from ordinary atoms in that they carry an electric charge.

Na+ =An-ions, go to the (Cathode — charge)

I— =Cat-ions, go to the (Anode + charge)

When a salt that ionizes, Sodium Chloride for instance, is dissolved in water, the Sodium atom loses one Electron and becomes Positively + charged. The Chlorine gains one Electron and becomes Negatively — charged. The number of charges upon an ion is equivalent to its valence, and the reaction is based on a combination between the ions which have the greatest affinity for each other.

$NaCl$	+	$AgNO_3$	⟶	$NaNO_3$		$AgCl$	
Sodium chloride		Silver nitrate		Sodium nitrate		Silver chloride	

Electrolytes.

From the standpoint of electrical conductivity we may establish two very important classes of compounds; electrolytes, and non-electrolytes. Electrolytes are substances which conduct an electric current when in solution. They are acids, bases and salts. They belong to the division of inorganic compounds, although some organic compounds, notably the proteins, organic acids and organic salts, are characteristic electrolytes. Non-electrolytes are substances which will not carry an electric current when in solution. Most organic compounds are non-electrolytes. Examples of non-electrolytes are sugars, starches, fats, and alcohols.

Electrons.

Electrons represent the electrical charge of the ions. Atoms are probably regular systems (like the solar system), each holding its own number of Satellites, or smaller bodies which are called electrons. Electrons are all alike and about 1/1800 the weight of the "H" atom. They can be separated from ordinary matter and so are capable of existing in the free state. Evidence goes to show they are really negative electricity which is a material thing. A body containing more than its normal number of electrons is said to be negatively charged, while one from which some of its normal number of electrons have been removed is said to be positively charged. Electrical energy is the energy of innumerable electrons in very rapid motion.

Acids, Bases, Salts, Poisons

As we all know, an acid has a sour taste and turns blue litmus paper red. Alkalies, on the other hand, have

a Caustic taste and turn red litmus paper blue. All the alkalies are bases and when exactly neutralized by acids, they form salts.

Hydrochloric Acid + Castic Coda = Common Salt + Water

$$HCl + NaOH = NaCl + H_2O$$

In the above reaction, Hydrochloric is an acid and Caustic Soda is an alkali and a base, while the common salt and the water represents the neutral salt and a neutral liquid. Reactions of the above kind are used to great advantage in case of poison. If you have swallowed a poison acid, drink a harmless alkali like Bicarbonate of Soda. On the other hand, should you be so unfortunate as to swallow a poisonous alkali, take a harmless acid like vinegar or dilute Acetic Acid. As a matter of fact, if you swallow a poison acid or alkali, you could drink another poisonous alkali or acid without any bad effect whatsoever, providing you had your proportions exactly right. I have here a bottle of Sulphuric Acid, commonly called Oil of Vitriol, and a bottle of Caustic Soda, both deadly poisons. I will test them with litmus to show you one is an acid and the other an alkali. I mix them together and they form a neutral compound. This neutral compound is Glauber's Salt in water and I will proceed to drink the solution. Here you have a case of a poisonous acid and a poisonous alkali forming Glaubers Salt, a harmless salt, and which I did not hesitate to drink. However, I must advise any of you from trying to perform this experiment unless you are sure you have the proportions exactly right, otherwise the result might be disastrous. (Applause).

The Chemical Fire Extinguisher

In the Chemical Fire Extinguisher which is used around most plants, you have an example of the chemical action of an acid on a salt with the liberation of a non-inflammable heavy gas that smothers the flame. I refer to the chemical fire extinguisher which is charged with Bicarbonate of Soda and Sulphuric Acid. When the extinguisher is reversed, or the bottle is broken, the acid is spilled on the Bicarbonate of Soda which forms Bisulphate of Soda, water and Carbon Dioxide, according to the followig equation:

$$HNaCO_3 + H_2SO_4 + HNaSO_4 + H_2O + CO_2$$

The Carbon Dioxide formed above is a heavy gas and being thoroughly saturated with oxygen, it cannot burn and therefore spreads like a blanket over any burning material, preventing the oxygen in the air from getting into the inflammable material, and thereby smothering the flame. I will now proceed to make a demonstration in this glass generator by adding Sulphuric Acid to the solution of Bicarbonate of Soda. (Demonstration). You will notice how the gas bubbles out and turns the lime water milky, precipitating Carbonate of Lime. In breathing we exhale the same Carbon Dioxide gas and it likewise precipitates Carbonate of Lime over the solution of Lime water. (Demonstration) Fake doctors have frequently used this reaction as a test for tuberculosis, scaring the life out of the patients.

I have here a pair of tall cylinders and I will now proceed to fill one with Carbon Dioxide gas. You will notice when I put the lighted taper into the cylinder containing air, it burns freely, but when plunged into the cylinder containing the Carbon Dioxide, it is extinguished at once. This shows the action of the gas on fire, and also shows that the cylinder is full of the gas. In order to show you how heavy this gas is, I will now perform a delicate experiment of pouring the gas from the cylinder full of gas into the empty cylinder. Although you cannot see it pouring in, I can assure you it is running into this glass like water. Again I use a lighted taper and demonstrate that the first cylinder is empty and the second cylinder into which I poured the gas is now full of Carbon Dioxide. (Applause).

Chemistry of Life.

In the previous experiment I showed you how we human beings expel Carbon Dioxide when we exhale our breath. This Carbon Dioxide is a product of Oxygen from the air and Carbon in the blood from the body. The oxidation and the formation of the Carbon Dioxide takes place in the lungs. On the other hand, trees, fruits, and in fact all vegetable matter exhale Oxygen.

As shown above, we exhale Carbon Dioxide. Plant life inhales this Carbon Dioxide, separates and retains the Carbon to make more wood fibre, fruits and vegetables, and exhales the Oxygen which we again inhale to make Carbon Dioxide by combining it with the Carbon we have obtained. From this you can readily visualize the Chemistry of Life.

We eat a piece of cabbage, which is mostly carbon and water; the carbon goes into the blood, the blood passes into the lungs; and the Oxygen from the air we breathe combines with this Carbon and forms Carbon Dioxide gas. We exhale this Carbon Dioxide gas. Another cabbage in the field inhales this Carbon Dioxide gas, takes the Carbon to make more cabbage, and gives us back the Oxygen to make more Carbon Dioxide after we have ourselves eaten more cabbage. So it goes on and has been going on for thousands and thousands of years.

The above you can readily understand if you will remember that when you have fish in an aquarium, you must put plants in to supply the fish with Oxygen, and if you have plants, you should put fish in to supply the plants with Carbon Dioxide gas. One balances the other.

pH Test.

Practically all industrial workers are familiar with alkalinity, acidity and neutrality. We all know how important it is that we measure these conditions in our work, as we have learned from experience that when these conditions vary our work will vary. The old

methods of testing by means of litmus and other testing papers sometimes gave misleading results. In industrial work, with the Hydrogen Ion control, operating conditions can sometimes be very greatly simplified and results can be duplicated more exactly.

The following quotation is from Dr. A. H. Grimshaw's explanation of the Hydrogen Ion determination. To explain the matter fully in a technical sense would cover more time than we have tonight, and personally I have never read a more simple explanation than that of Dr. Grimshaw. (No. Carolina State College).

"It is almost as simple to make a determination of hydrogen-ion concentration as it is to take a measurement of temperature; the only requirements are that the operator be able to read and to match colors.

Everyone is familiar with the Fahrenheit thermometer. On this scale, 32 degrees represent the freezing point of water. For sake of the illustration we shall assume that values above and below 32 degrees represent degrees of heat and coldness respectively. Thus, any values higher than 32 degrees, such as 34, 36, 40, etc., denote an increase in heat, the degree of heat increasing as the numbers increase. On the other hand, any values below 32 degrees, such as 30, 28, 20, etc., denote an increase in coldness, the degree of coldness increasing as the numbers decrease.

Hydrogen-ion Scale.

"In a similar manner the degree of acidity or alkalinity of a solution is expressed by the hydrogen-ion scale. Instead of being called degrees, as in the case of the thermometer, the units on this scale are called pH values. It is apparent that it is not necessary for a person to know the derivation of the term "degree Fahrenheit" in order to determine the temperature of a solution by the means of a thermometer. It is equally true that the worker need not know the meaning of the term "pH" in order to use this method for measuring acidity and alkalinity. On the hydrogen-ion or pH scale, a value of 7 represents neutrality. This means that, if the material being tested has a pH of 7, it is neither acid nor alkaline.

"Following the illustration of the thermometer given above, any values higher than pH 7, such as 7.2, 7.4, 8.0, etc., denote alkalinity, the degree of alkalinity increasing as the numbers increase. Analogously, any values lower than pH of 7.0, such as 6.8, 6.6, 6.0, 4.0, 2.0, etc., denote acidity, the degree of acidity increasing as the numbers decrease.

A pH value is therefore simply a number denoting the degree of acidity or alkalinity of a solution.

"In order that the worker may have some idea of the acidity corresponding to various pH values, it may be stated that a solution has a pH value of 5.0 is ten times more acid than one with a pH value of 6.0. Analogously, a solution of pH 4.0 indicates an acidity one hundred times as great as pH 6.0. A similar relationship holds on the alkaline side of the scale. That is, a solution which has a pH of 9.0 is ten times as alkaline as one which has a pH value of 8.0, etc.

Indicators

"The principle of making pH measurements is based on the fact that various indicators change in color when they are acted upon by various solutions of different acidities or alkalinities. Litmus paper is probably the simplest and best known example of an indicator. Its color change is from red to blue. That is, if litmus paper is dipped into an acid solution, it turns red. If it turns only slightly red, we say the solution is "slightly" acid. If it turns deep red, however, we say the solution is "strongly" acid. Similarly, if the paper turns blue, we say the solution is "slightly" or "strongly" alkaline. These are very vague and indefinite terms and their meaning varies enormously, depending largely upon the personal opinion of the worker. Thus, what is "slightly" acid to one worker might be considered as "strongly" acid by another, and vice versa.

"In making pH measurements, we substitute definite pH values such as 3.0, 6.8, 7.4, 9.6, etc., for the indefinite terms "strongly" and "slightly" acid and alkaline. These pH values can be recorded and can be duplicated at any time by the same or different workers.

"Theoretically, litmus and other test papers can be used for determining the pH of a solution. In practical application, however, the error is too great. One of the chief reasons for the inaccuracy of litmus is that the range is so wide that color changes are not distinct. This range is pH 4.6 to 8.4, which amounts to 3.8 pH units. It is practically impossible to tell the difference in the colors produced by solutions having pH values which differ by 1.0 pH unit. In fact it has been shown in actual tests made on different solutions which specially prepared litmus indicated to be alkaline were really acid, and vice versa, when accurate pH measurements were made on the same solutions.

"As stated above, litmus is very insensitive, partly because it covers such a large range. In order to make pH determinations, it is therefore necessary to employ indicators with short ranges, so that the color changes are more distinct. This means that we need a number of indicators to cover the entire pH range 1.2 to 13.6."

All liquids which contain water, according to the electrolytic dissociation theory, contain free H and OH ions, and when there are an equal number of each, then the solution is called neutral. If there are more H than OH ions, we have an acid solution, and if more OH than H ions, we have an alkaline solution.

Strong acids, such as hydrochloric or sulphuric, will be highly dissociated in solution and give a tremendous number of H ions as compared to weak acids, such as

acetic or formic, because these weak acids are not anywhere nearly as much dissociated in solution.

H-ion concentration is not determined by ordinary titration; and as this H-ion concentration, and not the total acidity, is of the most importance in chemical reactions, it is readily seen why we wish to make pH determinations in many cases. Two solutions, one containing N/10 sulphuric acid and the other containing N/10 acetic acid, would be equal by the titration method, but in H-ions, the sulphuric would be many times the stronger.

By electrical conductivity measurements, it has been found that the H-ion concentration of pure distilled water is 1/10,000,000. To avoid such large numbers, it was suggested to use the term "pH" the pH value being the logarithm of the reciprocal of the hydrogenion concentration. This value is 7, and it marks the neutral point on the pH scale.

It is readily seen from this that a solution having a pH value of 5.0 is ten times more acid than one having a pH value of 6.0, or one hundred times more acid than one having a pH value of 7.0, if we think in the terms of the comparative number of H ions. The pH value on the alkaline side can also be readily estimated, as each full degree above a pH value of 7 gives an increase of the OH ions amounting to ten times the number present in the degree just below.

As shown from the above, the neutral point of a solution is represented by 7. Various dyestuffs are sensitive to acid and alkali and there are a particular number of dyestuffs whose range as effected by acid and alkali are within a very limited curve and these limitations do not all occur at the same point. For instance, Bromthymol Blue has a range in the pH scale of 6.0 to 7.6—in other words, at 6.0 Bromthymol Blue will be yellow and we could say the solution was acid to the point of 6.0, while, if it were blue, we would say it was alkali to the point of 7.6. A solution of that character would be very close to neutral. If in testing we find we get a positive reaction one way or the other, yellow or blue with the Bromthymol Blue, we move up to the next color and so on until we get to a color indicator within whose range we are encircled. Then we stop and call that pH Value Acid if it is below 7 and alkali if it is above.

The above are the A. B. C.'s of the game. The pH concentration can also be measured by electrolytic conductivity.

In making the above test it will be necessary to make Buffer Solutions in test tubes for comparison. To do this you get some guaranteed distilled water. You keep it in a glass stoppered bottle, and every time, just before you use it, you boil it to expel the Carbonic Acid which is exhaled from your breath and also which exists in the air. You put this boiled, purified, distilled water into a test tube, add 2 drops of your Indicator and make your comparison.

NAME	pH RANGE	COLOR CHANGE
Meta Cresol Purple	1.2—2.8	Red —Yellow
Bromphenol Blue	3.0—4.6	Yellow—Blue
Bromcresol Green	4.0—5.6	Yellow—Blue
Chlorphenol Red	5.2—6.8	Yellow—Red
Bromthymol Blue	6.0—7.6	Yellow—Blue
Phenol Red	6.8—8.4	Yellow—Red
Cresol Red	7.2—8.8	Yellow—Red
Thymol Blue	8.0—9.6	Yellow—Blue

Vitamins

Another subject which appears mysterious is "Vitamins." As a matter of fact there is no mystery about it. Nobody has ever seen a vitamin. The name comes from two words "Vita" (life) and "Amine" (Ammonia Compound). The study of Vitamin was induced by the fact it was noticed that when white mice or other experimental mammals were fed certain foods, the results obtained such as growth, etc., were effected in various directions. The idea is not new, as the farmers have been practising Vitamin Chemistry for years—certain foods to make the chickens hatch, certain food to make the cow give more or better milk, and food to fatten the hogs, put weight on the beef, or pep in the old mare. Surely the farmer was the first vitamin man and he certainly knows a lot about it. The Vitamin expert has classified the certain foods as to results, but that is all; nobody has ever seen a Vitamin. At first it was thought that only eatables containing Amines (Ammonia Compounds) produced results. After it was found that all foods had more or less effect on the human body and the word was shortened to "Vitamins" and all included.

Big Words in Chemistry

When the reader who has had no training in Organic Chemistry runs across technical printed matter on Coal Tar products, he is frequently puzzled by what appears to be almost unpronounceable names. These names are not as bad as they appear to be. In reality they are descriptive. If the chemist had never seen the liquid water, and somebody presented him with a bottle and told him it was "water," he would not know what it was, but if somebody said "here is a bottle of Dihydrogen Oxide," he would know right away it was 2 parts Hydrogen and 1 part Oxygen, in other words H_2O. You will note we usually omit the figure 1, when only one atom is expressed. Then take the dye Methyl Orange or Orange 00. This is the Sodium Salt of Dimethylamidoazobenzenesulphonic Acid. Sounds terrible, but it isn't when we analyze it as follows:

Di—Latin prefix for two.
Methyl—Radical of wood (methyl) alcohol.
Amido—Organic chemical name for ammonia in combination with something else.
Azo—From the French for Nitrogen (Azote.)
Benzene—Benzene (Benzol.)

Sulphonic Acid—Treated with Sulphuric Acid.

Sodium Salt—Precipitated with Common Salt or Caustic Soda.

All of which tells at a glance that the dyestuff contains two Methyl Alcohol groups, combined with groups of Ammonia, Nitrogen, and Benzene, all of which were treated (sulphonated) with Sulphuric Acid and precipitated with Salt or Caustic Soda.

The reason we have these long descriptive names in organic coal tar chemistry is due to the fact that about the time coal tar chemistry was discovered we also developed a system of expression, while inorganic chemistry which developed slowly over a period of hundreds of years had all its compounds named before a system of giving explanatory names was developed.

Coal Tar Dyes

To most people the manufacture of a "Coal-Tar Dyestuff" is something mysterious and secret, when as a matter of fact it is a well-defined process and in no way difficult to understand. The materials used are limited and the operations (called reactions in chemistry) are few in number, and it is by combining and recombining of these materials and reactions that we reach the finished dye.

In the making of a coal-tar dye or Pharmaceuticals, there are three very definite manufacturing steps.

1. Crudes (Raw materials)
2. Intermediates
3. Finished dyes.

These are worked up by a few well-known chemical reactions (operations) the more common of which are:

Distillation—By direct heat or steam.

Evaporation—Driving off water or other volatile solvents.

Chlorination—Saturating with free chlorine.

Sulphonation—Treating and combining with Sulphuric Acid, usually high strength acid.

Oxidation—Adding oxygen, either from air or other chemicals.

Reduction—Taking away oxygen.

Diazotation—Treating with Nitrate of Soda and acid to add two atoms of Nitrogen (di-azo.)

Crystallization—Allowing a concentrated solution to stand until pure crystals are formed.

Fusion—Heating a solid substance to a melting temperature.

Sublimation—Heating a technical product until it volatilizes and then passing through a cooling chamber where it sublimes and falls purified to the bottom of the chamber.

These operations are performed in special apparatus, such as stills, auto-claves, sulphonators, and evaporating pans, usually made of iron or in some cases of an acid-resisting metal.

The development from crudes to finished dyes are beautifully illustrated by the Coal Tar Tree. The trunk represents the crude, the branches, the intermediates, and the leaves the finished dyes and pharmaceutical products.

New Developments in Chemistry

Penetrators

One of the latest developments in chemistry is an instant penetrator which acts only on the water and has no effect on the dye or the goods. It is of particular value in hosiery and wool dyeing and any place where a penetrator is required either for wetting out, dyeing or scouring. It is also particularly valuable in dyeing heavy materials. This Kali Instant Penetrator also has the property of preventing mildew and it is an antiseptic. I will make a simple demonstration showing you exactly how it works. (Demonstration)

Acid Proof Oil.

Another recent development is a soluble oil which will stand Sulphuric, Hydrochloric, Acetic, Formic, and in fact any acid. It will stand a saturated solution of Lime and Magnesium so that it is impossible for dough balls to form in hard water with this oil. Even with Chloride of Lime, the oil gives a clear solution. It is a big advantage in acid dyeing, or in hard water, or in any operation where lime, magnesium or other metallic salts are present. I will make a few tests with this oil showing you how it is not affected by Acetic Acid, Sulphuric Acid, Lime Solution, or Magnesium Solution. The Sulphuric Acid I am using is a 20% solution. This oil from its stable character has been named Staboleum, meaning Stable Oil. (Demonstration)

Instruments Used by the Chemist

Most of you are familiar with the tool and agencies we chemists use most frequently. However, of most importance is the thermometer, hydrometer, balance, the various graduates and heat. We use the metric system for both Volumetric and Gravimetric work and the common filter for most separations.

I certainly thank you for the attention you have given to this lecture and if there are any questions in chemistry you wish to ask, do not hesitate and I will do my best to answer them. Thank you, gentlemen!

NOVEMBER MEETING, RHODE ISLAND SECTION

THE November meeting of the Rhode Island Section of the American Association of Textile Chemists and Colorists was held on Friday evening, November 13, 1931, at the rooms of the Providence Engineering Society.

Dr. Robert E. Rose gave an interesting talk on "The History of Dyestuffs."

Dr. Rose is the Director of the Technical Laboratory of E. I. DuPont de Nemours Company.

About ninety members were present.

Respectfully submitted,

A. Newton Graves,
Secretary.

Proceedings of the American Association of Textile Chemists and Colorists

Problems of Textile Specification*

By **WILLIAM D. APPEL**

Chief, Textile Division, U. S. Bureau of Standards

MR. CHAIRMAN and gentlemen, it is a pleasure to be invited to speak to you a second time and I certainly thank the committee and you for the opportunity. I also thank you for the subject. I have boiled the subject down a little bit and have called it "Problems of Textile Specification."

Having read the accounts of the last two or three meetings and seen what a lively performance you put your speakers through, I put my stuff down here while coming up on the train, so that I wouldn't say something that I didn't mean to say.

At these previous meetings you have discussed the problems of the laundryman, the dyer and cleaner, the retail store and the consumer in relation to textiles that are in part the result of processing by textile chemists, colorists, dyers, finishers and other members of the Association. It seems to me that the problems of these diverse groups are nearly all problems of textile specification.

This is a subject of importance in my work on committees of the Federal Specifications Board and at the Bureau of Standards. Accordingly, propose to continue the discussion with special reference to this matter of specifications.

The most important link between producer and user of textiles is a specification. This specification may be a formal statement of what the user desires and what the producer will furnish, like those of the Federal Government and other large consumers. It may be a brief description or guarantee on a label. It may be merely an oral statement about the article to or by a sales clerk. It is not enough to let products speak for themselves. Appearances are often deceptive. The mere fact that an article is made of silk does not mean that it is necessarily good or desirable. An article made of some inferior textile waste may have superior characteristics for the purpose.

Many sales are accompanied by a statement—specification, if you please—of what the customer wants, with the assurance of the seller, actual or implied, that the customer is getting just that. Other sales are accompanied simply by a statement of the seller concerning the composition or utility of the article. This bridge between producer and user of textiles has to be built right if the industry is to flourish.

One example of accomplishment in establishing a bridge between producer and user of textiles to their mutual benefit is found in the work of the Federal Specifications Board. The Federal Specifications Board, perhaps I should explain, is not a part of the Bureau of Standards, though the Director of the Bureau is Chairman of it and members of the Bureau staff serve on its committees. Much of the testing of Government purchases of textiles for conformance with federal specifications is done at the Bureau of Standards.

Not many years ago, each of the purchasing agencies of the various government departments and independent establishments wrote its own specifications. For the past ten years, working through its technical committees, the Federal Specifications Board has written and promulgated a set of "Federal Specifications" for materials used by more than one department, that are mandatory for all branches of the government. For materials purchased by one department only, the specifications are written by that department and are called "Department Specifications."

The coordination effected by the Federal Specifications Board has resulted in economies in the procurement of materials and has been equally helpful to the producer. Every effort is made to bring the federal specifications into harmony with the best commercial practice. Producers are asked to criticize the specifications and to suggest revisions. The specifications are not promulgated until acceptable to the Government departments and to a considerable majority in the industry.

It should be emphasized that these are specifications for materials to meet very definite requirements of the Government. They are not designed for general use, though organizations that have similar needs frequently do use them. I mention this because a good many people write in and think that the federal specifications are for the best material or for material that it is compulsory for people to buy or something of that sort.

I have outlined this matter of federal specifications because the subject is one that somebody may want to talk about. I don't want to talk about it any more because I haven't anything to say especially about it.

The thing I want to emphasize now is that there are two types of specifications. "Material" or "manufacturer's" specifications tell the producer what raw materials he shall use, detail the processing it shall receive, and also may

* Presented at November Meeting, N. Y. Section.

state requirements for the finished product that are irrelevant to the actual needs of the user. They serve neither user nor producer to the best advantage.

On the other hand, "performance" or "consumer" specifications are of the greatest value alike to user and producer. They are not concerned with the materials or methods of manufacture but are a definite statement of the performance expected of the product in service. The performance specification allows the manufacturer the widest possible latitude in order that he may apply his judgment and experience and the latest technical advances in the art. It is highly probably that this procedure will give the best product to suit the service at the lowest cost.

A simple illustration of this principle is that of a specification for cotton twine. A manufacturer's specification would call for cotton, possibly specify the grade and staple, amount of cleaning, size and twist of singles, the number of plies, and the strength and number of feet per pound. Consideration of the requirements of the twine—let us say for the use of railroad mail clerk—shows that all of these requirements except the last two are irrelevant. What is required is twine with which can be tied a bundle of letters, using only one hand. Of course it must be strong enough to hold the letters but weak enough to break readily when it is snapped, because the mail clerk can't take time to use the knife or a pair of scissors. It must not cut the hand of the mail clerk who is using it in this way.

Accordingly, what is desired is a twine having a certain minimum diameter to avoid cutting and a breaking strength between two limits. The Post Office Department recently asked for bids on such a twine. Nothing was said in the specifications about the quality of the cotton or the appearance of the twine or the twist of the yarn or any of those things that very often find their way into such specifications. The manufacturer was given perfectly free rein.

Three interesting results have come to my attention. I am told that when the bids were opened, one of the manufacturers standing at the table where the bid samples of twine were being examined was very much surprised to find that the twine of the lowest bidder contained specks and shives and didn't have the nice, uniform appearance of his twine. Of course his twine was made from a much better grade of cotton—white cotton and so on, things that weren't called for at all.

Another manufacturer came to the bureau with the story that he had tried to meet the specifications, had succeeded in getting the diameter but his twine was too strong and he didn't know what to do about it. Of course he should have used a lower grade of cotton, put in some floor sweeps and such things, and he would have met the specifications easily.

The third reaction I have heard was that of an experienced cotton manufacturer who wanted to get a piece of the twine because he couldn't make head nor tail of the specifications. It simply didn't mean anything to him, because it didn't tell him how to make it. That, of course, I think was his job. He didn't know his raw materials and processes well enough to design a product for a service that takes two million five hundred thousand pounds of twine annually in the Government service alone.

Before a performance specification can be written for any commodity, an analysis of the needs of the user with respect to it is required. For many commodities the requirements are simply like those for the twine. For others, the properties really needed are often such intangible things as durability, appearance or handle, for which there are no standards nor even generally recognized test methods. Here the immediate problem is to develop test methods in order that the user may be able to give exact numerical expression to his needs and the manufacturer may have a yard stick with which to measure the quality of his product.

Since this work comes within the scope of this Association, I presume you will be interested in some recent progress in the development of such methods. A good example is the development of a test for water-proofed cloth, particularly duck, which is very much needed by the National Association of Tent and Awning Manufacturers.

The work I have reference to is that of Dr. Harold's sub-committee of the Research Committee, and it is being carried out by your research associate, Mr. Smith, at the Bureau of Standards.

Fairly satisfactory methods of measuring the waterproofness of a piece of cloth are available. It is not sufficient, however, to test cloth as it comes from the finisher because the user is not as much interested in whether the cloth is adequately proofed as received as he is in whether it will still be waterproof after a week or a month or a year of service. What is needed is an accelerated aging test which will simulate the action of wetting and drying, heat and cold, sunlight and repeated folding.

Mr. Smith has built a simple machine on which he can reproduce the folding action and he has been making a long series of exposures out of doors of fabrics to get the natural ageing. Then he has been studying in the laboratory the effect of light and heat and wetting and drying and so on under controlled laboratory conditions. He is not yet ready to propose an accelerated test because the outdoor exposures have not been completed, and unless the laboratory tests reproduce reasonably satisfactorily the results of the outdoor exposure, the tests wouldn't be of much value.

He is making good headway at that and may have something to say at the annual meeting. Another ageing test on which we have been working is one for weighted

silk. Some of you may remember the conferences which were held here two or three years ago, attended by the Silk Association, the consumer organizations, the retailers and so on. At that time everyone was thinking in terms of the amount of weighting. They couldn't seem to think of anything but the amount of weighting.

As a matter of fact, from the user's viewpoint, the more important question is "What are the properties of the silk, both as is and on aging?" The principal agencies which are detrimental to silk are light, heat and, of course, moisture plays an important part. Mr. Jessup in our laboratory has studied the effect of varying the intensity of the light, the temperature and of different humidities on the breaking strength and stretch of weighted silk in accelerated ageing tests. He worked with the same materials that were furnished by this committee two years ago.

Those same silks had been hung in a room where they received diffuse north light, which is not very strong light, and what I would consider a very fair ageing test for the silk. They deteriorated at very greatly different rates. At the end of nine months' exposure, some of them had completely gone to a powder, others had lost only ten or fifteen per cent of their strength. He tested these same fabrics in a set of conditions that he set up as an accelerated aging test and they deteriorated in the same order. In other words, he got very satisfactory correlation between the natural aging and the laboratory test. That will be published very soon.

Of course we have been working on the matter of fastness to light. During the past summer we have made certain experiments and they have turned out remarkably well. I had a letter from Mr. Cady the other day; he has looked over the exposures and they are lining up beautifully. We were trying to get a series of dyeings, representing the different steps of fastness. We have in mind seven steps, represented by six standard dyeings. We wanted those dyeings to behave relative to one another in the same way when they are exposed to sun tests or in the fadeometer, and the ones in the final selection have behaved very well.

You see, we are looking for a very practical answer to the immediate problem, a series of dyeings that you can have in your laboratory for comparison with the unknowns. Of course, ultimately the numerical expression for color measurement will be desirable but that seems to be something for the future.

Another characteristic of cloth that we have been interested in is the handle. I thing silk people have been interested in the handle of cloth. That is a very intangible thing and I think at first sight you would say it is perfectly hopeless to try to measure handle in any way. It is, of course, a complex problem but if you study into it, and we have, you will find certain physical characteristics of the cloth that are involved.

The weight of the cloth, of course, comes in. Three related properties have to be considered. They are properties that relate to the flexibility of the cloth. I will have to illustrate with paper. You know that when you fold cloth up, it kicks back. We can measure stiffness in an instrument that we call the flexometer, designed down at the bureau, in terms of the amount of energy required to fold the cloth up to a given angle. This back-kick of the cloth, or resiliency, is another physical property that can also be measured in energy units. If you fold the cloth over, it will behave like a paper, it won't come back all the way and a certain amount of the energy required to fold it is lost in creasing it. The creasibility of the cloth can therefore be given exact numerical expression by that.

We thought that we had handle pretty well licked but then we began to think about some other characteristics. Feel a piece of heavy cloth and of course the thickness comes into the handle, and the softness or hardness of the cloth, particularly of a fabric like underwear fabric, so we have built another gauge which is really a thickness gauge, which permits you to put a variable load on the cloth anywhere from no load to increasing loads and measure the thickness with different loads. Also, we can remove the load and measure the extent to which the cloth comes back. In other words, we are measuring the softness or hardness of the cloth. We are measuring the compressive resiliency and the energy lost in depressing it—the amount of deformation.

Those are the characteristics that figure in the handle of cloth and with these two instruments we give exact numerical expression to them. How they enter into a single numerical value for handle will depend on the use. You know the handle that is good for one purpose is not good for another. You must also take into consideration what is meant by good and bad, in other words, the use that you have in mind. Of course these same methods can be used for the control of finishing operations with respect to these properties.

I am told that whole lots of silk are sometimes rejected on the ground that the handle isn't right. That situation certainly can be taken care of. If you know what constitutes a good handle, you can keep the cloth there or you can combat unjust claims.

Another related property is the draping quality of cloth. That depends on the weight, stiffness and resiliency, which, of course, can also be measured.

Other consumer properties, as they might be called, are the comforting value of blankets, underwear, summer suits and fabrics designed to keep the body warm or cool. The heat transmission of the fabric, the air permeability and the moisture absorptivity are the characteristics you are concerned with there and all of them are measurable.

Another group of characteristics relate to dimensional changes, such as shrinkage when a garment is washed

or the stretching or bagginess when they are worn or the matting down of pile fabrics in service. These are simply dimensional changes and you can set up laboratory tests simulating the service and measure these changes and evaluate fabrics with reference to them.

The point that I want to make here is that many of the test methods needed for performance specifications are now available. The consumer should be encouraged to stop writing material specifications which must work logically to his detriment and encouraged to start writing performance specifications that are advantageous to both user and producer. The newer test methods should be adopted by the industry as rapidly as they are developed by this Association and others and used to a far greater extent in the control of production and the description of merchandise.

I want to add to that something written by one of my associates: "The test method and the results obtained from its use are really only a convenient and precise mode of expression. A single number, a result of a test, is sometimes more effective than a whole page of words in its ability to convey an idea. It is easy to coin words; it is perhaps more difficult to develop test methods. It requires patient effort to get the word into the dictionary or into general public use. Great patience and effort are required to get the word accepted by the industry or included in specifications. A hard, long time test should be started promptly."

I supposed there would be another speaker here. I have cut it rather short but I just wanted to start the discussion on any of these test methods or on specifications, whatever you care to talk about. Thank you. (Applause.)

Chairman Gaede: Perhaps the day isn't so far off when a customer may say, "Well, the handle isn't there on the goods," and can no longer get away with it, as he could before we could measure those things. Now, very often when the end of the season comes and he has a lot of goods on hand that he must dispose of in some way, he sends them back to the dyer or someone else and thereby finds a way out of his troubles. Perhaps some day we will have a means of testing the handle and some of these other problems on which we can only go by rule of thumb now.

It is not so long ago that the only way of testing dye liquor was by dipping the finger in it and tasting it to see how acid it was. Perhaps the day will soon come when we can answer some of these problems within a few hours.

I wish to ask if anyone has any question to ask Dr. Appel at this time.

Mr. Barber: Mr. Chairman, may I ask Dr. Appel if the Bureau of Standards has adopted a standard as to the number of threads to the inch or the picks per inch to a piece of white silk cloth to determine the amount of weighting that can be put on that fabric so that it will be a strong fabric, a serviceable fabric and a wearable fabric?

Dr. Appel: That is a job for the manufacturer.

Mr. Barber: It is a job for the dyer, too. Has it been established? That is my point

Dr. Appel: Not to my knowledge.

Mr. Barber: Some people are under the impression that between your Bureau and the Silk Association, there were such standards established. I only want to disabuse my own mind and the minds of many others of that impression.

Dr. Appel: Many people have the impression that the Bureau of Standards establishes standards for industry. It doesn't. The Bureau of Standards will help industry establish standards for itself, and that is why we were at the meetings with the Silk Association and others. However, the Bureau does not establish standards and urge them on industry or anything of that sort at all. If the industry will find the standards it wants, the Bureau will go on with it and help try to make them more general and widely recognized.

Mr. Barber: Then the Silk Association has not established any standards in conjunction with your Bureau?

Dr. Appel: Not to my knowledge.

Mr. Freedman: I believe Mr. Barber has reference to something which took place at the last meeting ——.

Mr. Barber: No, I have not. This is a general thing which has come up in my experience.

Mr. Brosnan: In connection with the machine which has been devised for testing waterproofing, I would like to ask if they are considering the materials to be used outside or whether the machine is being designed to test materials like shower bath curtains?

Dr. Appel: Well, of course, we have two tests. You are familiar with the box test for testing the waterproofness of the fabric?

Mr. Brosnan: In my judgment that is not suitable for shower curtains.

Dr. Appel: In the testing of waterproofness of a fabric, we are interested in the pressure just necessary to force water through the cloth and that as a function of time. We have a box, the fabric is clamped on to it to form one side of the box. The box is then filled with water to a certain level and the level is maintained. We can notice on the face of the fabric the height to which the water comes through. We can also observe that at different periods of time, of course, and the changes with time, and we can measure the amount of water that comes through.

Dr. Barr, in the National Physical Laboratory in England, has done some work on the correlation on hydrostatic pressures and the hydrodynamic pressures of a driven rain. We haven't done anything on that ourselves. Dr. Freedman is on Dr. Harold's committee and that committee has talked of trying to study showers with

different sized drops and dropped from different heights in order to get a better correlation between rain and that of showers. We think that we can measure all the essential characteristics of a fabric with reference to waterproofness with the box. It was designed primarily, however, for ducks and heavy fabrics, so we are using quite a depth of water.

For the light, porous waterproofed fabrics, it doesn't work so well though we can get the depth just necessary to force the first drop through, the minimum pressure necessary to put water through. One of the finishers has taken that box and put it over on its side so that the fabric forms a sloping surface, the depth of the water is less and it is graduated over a larger surface so you can read it quite satisfactorily, and I was told by the firm that was using it that they had very satisfactory results with it. I don't know. I would be interested in your experience with that sort of test for shower proof materials.

Mr. Brosnan: I built a machine a couple of years ago where the column of water was raised on one side and I found on ducks and heavy materials that were fairly tightly woven it was fairly satisfactory but for shower sheets made of cotton and rayon, it wasn't. In that test, the pressure was entirely out of relation to what to expect from the use of the fabric. Most of the light fabrics would have drops of water come through almost instantly and still they would work out very satisfactory as shower curtains.

Mr. Freedman: In that relation, I would like to say that recently there have been placed on the market some shower curtains which are incapable of resisting a hydrostatic pressure of eleven centimeters. Those curtains are meeting with a great deal of customer resistance. They are being returned because they are unsatisfactory. That may help you in judging the value of some of those cloths.

Chairman Gaede: Are there other questions?

Mr. Carter: I would like to say these considerations we have are for water-repelling, not for waterproofing. You know we discriminate between the two terms. For instance, in a shower bath, the water comes down and slides off the curtain like a duck's back. Waterproof will not let the water through. For instance, shower curtains are in a great number of cases waterproofed with a rubber composition. Those are absolutely waterproof. I think you were talking about water-repellant, note waterproof.

Mr. Freedman: Mr. Carter, the term "waterproof" and "water-repellant" are frequently used, although the term "water-repellant" may be used to describe material which is waterproof or water-repellant. The difficulty is that quite frequently merchandise materials which have been treated with a water-repellant are described not as waterproof but "waterproofed." To the uninitiated that term is considered as waterproof or describing the merchandise as waterproof.

Mr. Carter: You know there is a finish for shower curtains which is a rubber finish.

Mr. Brosnan: In making a test of that kind, there ought to be a ratio set up between the porosity of the fabric and the waterproofness. The more open the weave—.

Dr. Appel: Yes, Dr. Barr pointed that out. He was concerned almost entirely with the porous waterproof fabrics, and it is quite true that the better of two fabrics of the porous kind, the kind you can breathe through, so to speak, is the one which allows more air to pass and is still repellant.

Mr. Bergh: Mr. Chairman, I would like to ask Dr. Appel a question. I understand that the Bureau of Standards came out with a recommendation that as a standard for silk, the wearability should be used as a basis and they mentioned that the tensile strength was one of the tests that should be used. I wonder if there was included in the test the elastic and the lasting qualities of the silk?

Dr. Appel: Do you refer to my remarks this evening?

Mr. Bergh: I refer partly to your remarks and I believe the Bureau of Standards came out with a recommendation to the silk trade.

Dr. Appel: I don't think the Bureau of Standards has made any recommendation to the silk trade because that is not the policy or the function of the Bureau. Of course when we have tested these things, we have also tested the elongation. Is that what you mean by the elastic qualities? You mean the lasting qualities? No, the point is that I consider those more important to the user than the amount of weighting. Of course the fabric must have a certain minimum strength or it wouldn't serve at all but if it has sufficient strength and appearance, then the question is will it retain those characteristics, and that is the thing we need to test for. It would seem to me very much more logical from the consumer point of view, if you were standardizing silk fabrics, to set some standards or limits for different degrees of wearing properties, strength, appearance and so on, than for the amount of weighting.

In other words, the consumer doesn't really care how much weighting there is on the silk if it has the appearance, the feel and the lasting qualities that he expects to get from it.

Mr. Bergh: That has always been my standpoint in that matter.

Dr. Appel: Of course a consumer may want silk for the reason that silk in itself is desirable, perhaps for historical or sentimental reasons. In that case, the consumer should have silk, I would say, but I think that for a large majority of the ordinary purposes, the consumer should not insist on silk but he should insist on these other characteristics which we have just mentioned.

Mr. Bergh: May I ask, Dr. Appel, has any method

been developed whereby the lasting tests may be made in a fairly reasonable time?

Dr. Appel: In these experiments to which I referred, a forty-hour exposure to the light under certain conditions of temperature and humidity—laboratory tests—corresponded to something like nine months of hanging in diffused north light. It was only an approximation but the results were certainly good enough for correlation to say—well, one sample in that time will have only three per cent of its original strength. Another sample will have ninety per cent of its original strength. So that in forty hours you get a pretty good idea of the comparative rate of deterioration of those samples.

Mr. Bergh: Would that be by exposure to a high heat or to light?

Dr. Appel: I can only tell you the approximate conditions. They were exposures to the carbon arc of the fadeometer, the distance was perhaps fifteen inches. The samples were hung in a box in which the temperature was controlled, I think to about seventy degrees Centigrade, maybe sixty, and the humidity was that given by a saturated solution of salt, about seventy-five per cent relative humidity.

Mr. Barber: Dr. Appel, will you inform me if there is still contact going on between the Bureau of Standards and the Silk Association committee as to eventually establishing standard texture for weighted silk? I will tell you why I ask that question: A Mr. Gilbert read a paper here from the Bureau of Standards. He left the impression with his audience that there had been a definite standard established between the Silk Association and the Bureau.

Dr. Appel: Not to my knowledge. So far as I know, the committee of these various groups that were so active several years ago has not taken much interest in the subject recently.

Chairman Gacde: Are there any further questions?

Mr. P. J. Wood: I think Dr. Appel in his very ingenious department ought to be congratulated on the progress they have made in establishing standards for determining very many factors affecting our industry, but probably one thing they could do to eliminate a great deal of grief so far as the finisher is concerned would be to establish standards for finish and definitions of finish.

I have been in this business a great many years and I have seen the terms defining finish change probably about as much as women's fashions. A great many years ago we had the term "a lofty finish.' I see an old silk man in the audience, he will remember a great many of these expressions that have been used and have died away again. We hear today no more about the lofty finish. What it was, I didn't know and nobody knew but when they wanted to complain about a thing, the finish wasn't "lofty" enough.

We are still in the same condition today after—well, in my experience, twenty-three or twenty-four years. We have today a firm finish, a heavy finish, a raggy finish and all these terms are absolutely without proper definition. If we could establish numerical values for these different names, I think Dr. Appel would confer a boon on the entire industry.

A man once told me that the matter of finish was bound up with what a man had for breakfast. I think that must be so because I have a very clear recollection of sending a hundred pieces of goods to a fellow and he sent them back saying they were absolutely useless—the finish was entirely wrong. They came back to the mill and we sent them down in the truck the next morning and he said they were fine, why hadn't we done them that way in the first place? Which shows the man's judgment was either warped on the first day or the weather had something to do with it.

The matter of weather we know does affect finish to a certain extent, probably less now than in the old days when we used to use some materials which are no longer used.

If we could agree on certain standard names for different finishes, I think a great step forward will have been made.

Dr. Appel: I would like to reply to that. I think Mr. Wood must have a very exalted opinion of us down there at the Bureau if he thinks he can send some cloth down and we will inspect it and study it and tell what the man who rated it had for breakfast. I will make an offer that if the Association, or if Mr. Wood or somebody will honestly prepare a series of samples which have a "lofty" finish to different degrees, so that they are rated by someone who knows his stuff as to the degree of "loftiness" of the finish, we will undertake to measure the characteristics which vary with that degree of "loftiness."

That of course is necessary before you can give a numerical expression to those things or to define them in any way. I am very much afraid that some of those characteristics that we speak of have more to do with what the man had for breakfast than the actual property of the cloth.

Mr. Barber: Dr. Appel, I think maybe I can give Mr. Wood and yourself a little light on that. When I was a boy, I worked in the finishing room. In those days we sprayed only with glues and gelatine and so on, but we didn't rush the goods down to the selling department the same afternoon and deliver them right out. We put them in a cellar that was lined with bricks without mortar between so the moisture out of the earth got into the goods and the goods stayed there for seventy-two hours, and instead of the word "loftiness" it was "heft" or the handle of the goods, which I think is what you meant. The "heft" of the goods was how it felt in your hands. There is a great deal, I think, to be said for that, that we are rushing the goods too quickly from the dyer and finisher to

the customer and we don't let them stay somewhere where they will get the natural moisture so that they will get "hefty" and the customer will be better satisfied.

Chairman Gaede: We have discussed silk pretty thoroughly. What about cotton or wool?

Dr. Appel: Raw wool standards are not handled in the Bureau of Standards. They are handled in the Bureau of Agricultural Economics, in the Department of Agriculture. They are practical standards in that there are grades, I think, established by the way the wool man feels the stuff. The matter of diameter has, of course, been applied to them, and I expect they are defined now partly in diameter.

Our only contribution to that matter of evaluating the diameter of wool was the development of an instrument, really invented a long time ago by Thomas Young in England, an eriometer with which we can rapidly measure the average diameter by an optical method. That instrument is capable of further development. I don't think it has been applied in a practical way by anyone, certainly not to any great extent. I think that any requests along that line should go to the Bureau of Agricultural Economics.

Chairman Gaede: Dr. Appel certainly has a vast store of knowledge in regard to these various instruments which are being developed for testing the intangible qualities and perhaps someone would like to know about some other problem that may be confronting him.

Mr. Carter: Quite a lot has been said about testing fabrics and other materials from the standpoint of getting a single number to represent them. I think that is a point there which would be well worth considering. For instance, from the standpoint of a cotton yarn or cotton thread, you specify a thread by its count and by its strength on any one of a number of testing machines. You take a yarn, say, supposed to be an 80's and you can test it first for size, and your first sample may be run 78, 79, 80, 81 and 82, until finally you end up with a yarn that would average an 80.

You take a certain sample and you can find testings which instead of being within a range of about four, might run in a coarse size down to a 65 or a 70, and it might run on the fine side to a 90 or 95 or possibly even further up, and yet both samples will average to the same count.

In the same way you can take a strength where you may have one which will give on a definite testing machine an average breaking strength of three pounds, and that may be apprised at values running from two and three-quarters pounds to three and a quarter. You may take another grade which will run, for instance, from a pound and a half to perhaps four pounds, and yet that will average three pounds. Now, both of these cases could be represented by one number, but in one set of observations, where your values are close, you would have an excellent product and in the second set of observations where you may get the same numerical answer, you will have a mighty poor product.

I wonder if anything has been thought of in that connection?

Dr. Appel: Well, of course that does come in very strongly in the quality of your yarns or threads or the wool, and the variability in the actual diameter of the individual fibers in the wool. It certainly affects the serviceability very much. All I can say is that it should come in. You have a measure, of course, in the deviation from the average. Both the maximum and the average deviation can be expressed mathematically.

Chairman Gaede: Wouldn't that be expressed by certain high and low limits, Dr. Appel, in the case of a thread?

Dr. Appel: Either by high and low or by the average and mean deviation, or somehting of that sort, as is done mathematically right along in handling such.

Mr. Wood: Wouldn't you taken into consideration another factor, the factor of uniformity, that is, uniformity in size? Isn't that true? We have in the silk business a method of testing which Mr. Barber can tell you about. It consists of widening the yarn and observing the uniformity of the threads.

Mr. Freedman: From the consumer's point of view, the yarn or thread disclosing uniform strength is always preferred to that which shows non-uniformity even though the average may be slightly higher for the non-uniform product. The thing taken into consideration is the old slogan that the chain is only as strong as its weakest link. If the yarn breaks at one pound at its lower limit and four pounds at its highest limit, with an average of two and three quarters pounds, while the other yarn is uniform, say, at two and a quarter, then the yarn showing the greater amount of uniformity is the one that is desirable.

During the past couple of weeks we have had some interesting experiences here in which during the testing of blankets we found that some blankets disclosed an average tensile strength in the filling direction of twelve pounds. The tensile strength in some portions of the blankets rose to as high as eighteen pounds but in other sections was as low as three pounds. Of course that blanket wasn't nearly as good as one having a uniform strength of nine pounds.

Mr. Barber: Wouldn't that arise, Mr. Freedman, very much from the amount of twist and the combing of the wool, so that the wool was thinner in some places than in others, and you would get that great variation in your tensile strength?

Mr. Freedman: It may be due to the degree of napping but the fact remains that from the consumer's angle, the blanket with the lower average tensile strength was the superior product.

Chairman Gaede: We still have time for some more questions.

Mr. Sokolinski: On the Government twine, Dr. Appel, that you were speaking about, the bids were reopened again recently, weren't they? Would the party that had the high grade twine be able to get a sample of the so-called inferior product, so that he could use a similar material? Isn't it true that the bids were reopened?

Dr. Appel: Those first bids were thrown out because they wanted to have jute compete again. I think the new bids have not been opened. They have just been asked for.

Mr. Sokolinski: Is it possible for those with the higher grade twine to procure a sample of the regular material?

Dr. Appel: It is possible that the Post Office Department could furnish that, yes.

Mr. Sokolinski: I just ask as a matter of information.

Dr. Appel: People frequently come to the Bureau for such things but we don't have them. The Post Office Department might be very glad to do that, because apparently the cotton twine manufacturers haven't been on their toes in the possibilities of that specification for them.

Chairman Gaede: Has anyone else any other problem? We seem to have exhausted the subject.

We have certainly been fortunate in having Dr. Appel with us this evening. He is very well versed on all these subjects and seems to know everything up to the minute in what is going on. I am sure we have all profited very much by this paper and discussion. I would like to ask for a rising vote of thanks to Dr. Appel.

. . . The audience rose and applauded . . .

Chairman Gaede: If there is nothing further the meeting stands adjourned.

. . . The meeting then adjourned at nine fifty o'clock . . .

The Effect of pH on the Photo Chemical Decomposition of Silk

By MILTON HARRIS* and DANIEL A. JESSUP

The extent to which silk is weakened by light depends upon its "pH" (as defined by its extract), other factors remaining constant. The maximum stability is found at about pH 10. Above pH 11 and below pH 3 the stability decreases rapidly. In the neutral region, pH 6 to pH 8, silk is less resistant to light than when it is more acid or alkaline. Silk treated with tenth normal sodium hydroxide solution is more stable to the action of light than either the untreated silk or silk treated with tenth normal sulphuric acid solution. The acid treated silk is least stable. These facts have an important bearing on practical silk finishing as well as on the nature of the action of light on silk.

I. Introduction

ALTHOUGH silk is one of the strongest fibers known, its susceptibility to attack by light has been the source of considerable trouble, especially where the fabric has been exposed for any length of time. Formerly, many investigators believed that only silk containing metallic weighting was attacked by light, but recent work has shown that the purest silk is affected.

Concerning the nature and mechanism of the breakdown, there are many and diversified opinions substantiated by little experimental work. Doree[1] states that the breakdown is caused by ultra-violet rays acting either alone or in conjunction with the ozone produced by them. K. Homolka[2] and P. M. Grempe[3] state that the weakening of silk fibers by radiation is caused by the short ultra-violet rays from the sun. However, it should be noted that the sun's rays do not contain much short wave length ultra-violet and that this radiation does not pass through ordinary glass. (Radiation which passes through ordinary glass weakens silk.) Hermann[4] studied the effect of radiation on silk using the mercury arc lamp. His results indicate that the radiation acts directly on the silk and that the deterioration is not a secondary reaction due to the ozone produced by the radiation.

While the experimental worker in textile fields has limited his studies largely to the effect of light exposure on tensile strength, the protein chemist has studied the chemical changes produced by light. Schanz[5] has shown that heat and light effect chemical changes in egg and serum proteins in acid and alkaline solutions and that the action is increased by the presence of oxygen. By exposure to sunlight, Effront[6] decomposed amino acids and protein matter in alkaline solution with the formation of ammonia and volatile acids. He found that sterile solutions of peptones exposed to sunlight decomposed with formation of peroxide, nitrates, ammonia, and volatile acids. He concluded that the active agent was hydrogen peroxide as this substance is known to decompose peptones and amino acids.

* Research Associate.

II. Experimental Methods

A suitable and reproducible accelerated aging test was obtained by exposure to the light of a glass enclosed carbon arc, the external physical conditions being held constant. This was accomplished by placing the samples in a cabinet (15 by 15 by 15 inches) having a window of a special glass which is more transparent than window glass to the shorter wave lengths. The total radiation at a distance of 15 inches from the center, at right angles to the arc, operated on a current of 12.6 amperes, is 0.075 watts per cm^2. The temperature of the box was kept at 70° C. by a small fan for circulation and a thermostat control, most of the heat being supplied by radiation from the arc and the remaining heat from a carbon filament lamp bulb. A relative humidity of about 75 per cent was maintained by a saturated solution of sodium chloride.

Tests were made on pure silk which had been carefully boiled off and kept in the dark. Warpwise strips 48 inches long and about 1¼ inches wide were cut into 6 inch lengths. Enough warp threads were then removed to make each strip 1 inch wide. Each sample was allowed to remain in a solution of known pH for 10 minutes after which the excess liquor was removed by centrifuging for three minutes and subsequent drying in the dark.

The pH of the solutions was determined with the quinhydrone and hydrogen electrodes. The "pH" of the cloth (as defined by its extract) before and after exposure was obtained by extracting a standard sample for one hour with 50 cc. of water, using an Underwriter extraction cup. The pH of the resulting solution was taken to be that of the cloth.

The tensile strength of the samples was measured on a pendulum type of testing machine. All samples were thoroughly conditioned and tested in a room maintained at a relative humidity of 65 per cent and a temperature of 70° F. The average strength of three to five samples is reported.

III. Experimental Results

In order to determine the relative effects of the chemical treatment, light, and heat, three sets of samples were prepared. Each set was treated with solutions of sodium hydroxide or sulphuric acid ranging in pH from 1 to 13. The first set was allowed to stand in the dark at room temperature, the second set was exposed to a temperature of 70° C. and a relative humidity of 75 per cent without light, and the third set was treated as the second except that it was exposed to the light of the carbon arc. All exposures were for 30 hours. The breaking strengths of the sameples are given in Table I.

Table I.

Relative effects of pH, heat and light on the breaking strength of silk cloth.

	Breaking Strength		
pH	In Dark Room Temperature lbs. per in.	In Dark 70° C. & 75% R.H. lbs. per. in.	Exposed to Carbon Arc Radiation 70° C. & 75% R.H. lbs. per. in.
1	35	19	5
3	50	51	40
5	48	52	41
7	51	51	40
9	55	50	44
10	49	46	46
13	52	36	32

It is apparent from the results that in all cases with the exception of pH 10 the breakdown obtained was accelerated by the action of the light. However, it is known that proteins in general are very susceptible to acid or alkali concentrations of 0.1 normal or greater. Even under these extreme conditions, the tendering was increased by exposure to the light.

Three sets of samples were prepared and treated so that the pH of the cloth ranged from 1 to 13. These were all given a 30 hour exposure and the average strength at each pH was taken. The following results were obtained:

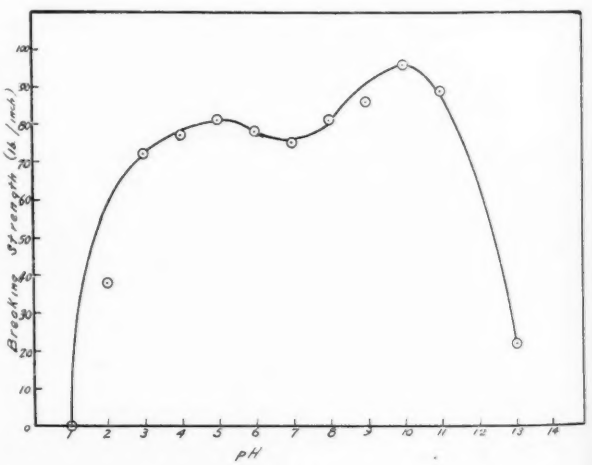

Fig. 1

Effect of light on the breaking strength of silk cloth at varying pH values.

TABLE II.

Effect of light on the breaking strength of silk cloth at varying pH values.*

pH	Breaking Strength lbs. per inch
1	0
2	38
3	72
4	77
5	81
6	78
7	75
8	81
9	86
10	96
11	89
13	22

*Silk used here was of a heavier quality than that used in Table I.

Several interesting points are portrayed here. As is evident from Figure 1, there is a definite region of maximum stability at about pH 10. The strength falls off rapidly below pH 3 and above pH 11. In the intervening range, there appears to be a minimum in the neutral region. Assuming that the protein material unites with small amounts of acid or alkali to form protein salts, the evidence indicates that the salts thus formed are more stable toward photochemical decomposition than the pure protein. Protein salts are probably also formed above pH 11 and below pH 3, but in these cases excessive deterioration is more than likely caused by direct action of the excess acid and alkali.

An analogous reaction takes place in the photochemical oxidation of adrenaline. Vacek[7] found that light accelerates the reaction considerably. He observed that aqueous solutions of adrenaline decompose much more rapidly than solutions of adrenaline in dilute hydrochloric acid in which adrenaline hydrochloride is formed. Preliminary experimental work indicates that the decomposition of silk by light is a photo-oxidation reaction.

The relative rates of deterioration were determined by the following scheme: The first set of samples was treated with a solution of 0.1N sodium hydroxide, the second with a solution of 0.1N sulphuric acid, and the third was untreated.

The results in Table III and also in Figure 2 show the relative stability of neutral, acid, and alkali treated silk to light. After a 50 hour exposure the acid treated sample had lost 67 per cent of its original strength while the alkali treated sample had lost only 23 per cent.

TABLE III.

Effect of light on the breaking strength of silk cloth treated with 0.1N, NaOH and with 0.1N H_2SO_4.

Time, Hrs. of exposure	Breaking Strength pounds per inch No treatment	0.1N NaOH	.1N H_2SO_4
0	98	..	..
5	..	99	80
15	..	98	63
20	..	95	53
25	..		45
30	82	88	38
50	..	75	22
75	50	59	..
100	..	56	..
130	21	48	..

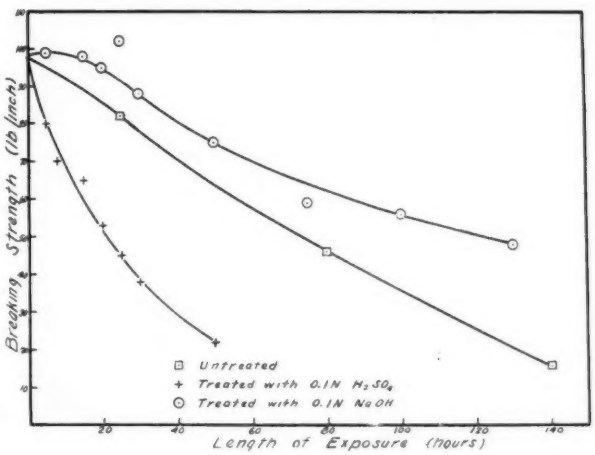

Fig. 2

Effect of light on the breaking strength of silk cloth treated with .1N NaOH and with .1N H_2SO_4.

IV. Conclusion and Practical Significance

These experiments show conclusively that silk decreases in strength on exposure to light and that the rate of deterioration depends upon the pH to which the silk has been finished. Contrary to what might be expected from the fact that alkalies hydrolyze proteins more rapidly than do acids, silk treated with O.1N NaOH is more stable in light than silk treated with O.1N H_2SO_4. Silk whose water extract has a pH of about 10 shows maximum stability to light. The stability decreases rapidly above pH 11 and below pH 13. From pH 6 to pH 8, that is, in the region of neutrality, silk is less resistant to light than when it is more acid or alkaline. This suggests that the protein salt is more stable than the pure protein.

These observations lead at once to the very practical conclusion that commercial finishing should leave silk at a

"pH" of about 10 if the maximum stability to light is desired. Whether other considerations will permit of such finishing must be decided for the materials to be processed.

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NOVEMBER MEETING, NEW YORK SECTION

THE November meeting of the New York Section of the American Association of Textile Chemists and Colorists convened at 8:15 o'clock, Friday evening, November 20, 1931, at the Alexander Hamilton Hotel, Paterson, New Jersey, Chairman Robert H. Gaede presiding.

. . . A short business session was held . . .

Chairman Gaede: I invited a number of friends to come to this meeting tonight. The first thing they asked me was who was to be the speaker. When I told them it was to be Dr. Appel, of Washington, Chief of the Textile Section, invariably they said, "Fine, I will surely be there."

I would like to introduce Dr. William D. Appel, Chief of Textile Section of the United States Bureau of Standards, whose subject will be "Standardization of Textiles of Interest to Dyer and Finisher from the Point of View of the Work of the Textiles Committee of the Federal Specifications Board and the Work of the Bureau of Standards." Dr. Appel! (Applause.)

(For Dr. Appel's address see page (342, 788).

AMERICAN DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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MAINTAINING PROFITS

OF RATHER increased interest at this particular time is a Department of Commerce bulletin outlining methods adopted by various concerns who have succeeded in maintaining or increasing profits during the depression. The examples cited were gathered from the various district offices and commodity divisions of the Bureau and from business publications. The investigations were not exhaustive but they serve to indicate general procedures in vogue.

In certain cases present success was attributed to past policies which have been proven sound during the present crisis. Dependable business practices are always applicable, whether business is booming or falling off. In other cases the past policies of a concern have been found faulty for present applications, and changes have been made. Although the effect of these changes is not yet apparent, if they are basically sound, they will eventually be of benefit. When business sales are built upon quality and fair price, quick delivery is of secondary importance. That is why many concerns, whose production was rapid but of questionable quality, have found it necessary to make changes in their business practices.

Especially noticeable because of the frequency of their application in the types of policies advanced as a reason for maintaining a successful sale and profit record, are changes in product policy and advertising campaigns. Out of 80 concerns who made a change in their advertising policy 29 made increases, 19 maintained their regular amount, 5 listed their advertising as "aggressive," 4 as "careful" and 4 reduced the amount of advertising. Other changes totaled 17 in number. An analysis of why advertising is increased by some concerns during a period of depression reveals the following facts: People have more time to read advertisements. They are more impressed by what appears in them. Furthermore, although it is not a good policy, many firms curtail advertising to cut down expenses. This is especailly true in the trade papers and technical journals. As a result, those that do appear are more prominent. Their display value is greater.

Under a total of 91 who replied that product changes helped them maintain a profit, 20 listed new products, 20 improved quality of product, 17 changed the product to increase consumer appeal, 14 diversified their products, 5 listed packaging, and 3 listed specialization.

The largest single item mentioned comes under the heading "Sales Effort" and is listed as increased sales effort.

Firms who previously conducted their business in a haphazard manner and were still able to show a profit, found it necessary to reorganize their entire policy in order to continue. Those that were not possessed of sufficient means as enterprising organizers, were forced to close. This is noticed particularly in the case of those firms who grew with the boom and then found themselves stranded. Normal business conditions requires the application of sound business principles.

THE ANNUAL MEETING

THE Annual Meeting of the American Association of Textile Chemists and Colorists for 1931 is over. It marked the end of ten years of service. A wealth of ideas were amassed from all over the country, from each local section, and by means of discussions and open forums were disseminated. Men who were well qualified for the task spoke of new and interesting phases of the textile chemistry and dyeing industry.

Such an organization represents the real spirit of cooperation. There was no selfish motivation in the organization of this society. Of course, it stands for the advancement of its own industry, but not for the individual members alone. Such associations open the door for honest criticism which is well received and properly taken to heart.

It is slightly over ten years ago that the Association was first organized. In an editorial entitled "Fulfillment" appearing in the AMERICAN DYESTUFF REPORTER of November 7th, 1921, we read the following:

"By a happy intermingling of circumstances and design, it is now written that two great scientific Expositions will have marked the official opening and close of what may be termed the crystallization period of the American Association of Chemists and Colorists. The Chemical Exposition in New York witnessed the preliminary gathering, at Rumford Hall, the Chemists' Club, when the project for the first time began to assume tangible form and the decision to organize was definitely taken. It is peculiarly appropriate, in a double sense, therefore, that the International Textile Exposition in Boston should witness the consummation of that resolve through the Inaugural Meeting of the Association on Thursday, November 3rd, at the Engineers' Club.

"The immediate occasion of this inaugural meeting—

the precursor, we trust, of an endless chain—was the agreement arrived at in New York. Its true cause, however, arises from the needs of the past, which have grown even more insistent as the art of coloring textiles has been advanced by science. Lacking such an organization as the one now about to be launched, the American textile industry, no matter how efficient and resourceful in other respects, must always have been incomplete. Possessed of it, its potentialities should be realized to a greater degree than has heretofore been possible . . .

"The AMERICAN DYESTUFF REPORTER regards this inaugural meeting as a most significant and vital step in the history of the textile industry of this country, as well as a long step toward the solution of many annoying problems; and it would add to the host of others its good wishes for the complete success of the Association in all its undertakings."

The Proceedings of the Association first became a regular part of the AMERICAN DYESTUFF REPORTER in the December 5th, 1921, issue. A notice appeared on the front cover to the following effect:

"This section includes the initial appearance of the Proceedings of the American Association of Textile Chemists and Colorists which will become a regular feature of the REPORTER from this time forward."

Included in that issue was the account of the organization meeting, the Constitution, and the list of Charter Members. There were 255 members at the time of organization. At the present time the list runs well toward 1,500. The first officers were as follows: President, Louis A. Olney; Vice-Presidents, William D. Livermore and William H. Cady; Secretary, Walter E. Hadley; Treasurer, Winthrop C. Durfee; and Councilors, James L. Amsden, Elmer C. Bertolet, Arthur E. Hirst, George A. Moran, William K. Robbins, and Walter M. Scott.

And now, after ten years, the AMERICAN DYESTUFF REPORTER congratulates the Association on its past record of accomplishment, and extends its best wishes for continued successful endeavor, and, as always, the REPORTER remains an integral part of the Association in distributing, through the Proceedings pages, news of its work.

Addenda

ED. NOTE:— These notations refer to the article "The Effect on Wool of Temperature and Hydrogen Ion Concentration of the Scouring Bath," Page 743, November 23rd issue.

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Celliton Fast Navy Blue BR

The General Dyestuff Corporation releases Celliton Fast Navy Blue BR Powder, a new dyestuff for the dyeing of acetate silk from a soap bath, said to produce fuller navies than the existing B and GT brands.

The product is also said to possess good to very good fastness properties and levels well, which makes it suitable also for pale combination shades.

S. O. C. M. A. Meeting

A meeting of the Synthetic Organic Chemical Manufacturers Association was held at the Chemists' Club, New York City, on Thursday, November 19th, at 12:30 P. M. President Merz presided. C. C. Concannon, Chief of the Chemical Division of the Bureau of Foreign and Domestic Commerce, addressed the group on the activities of the Bureau. John G. Lerch, of the Association's counsel, brought to the members' attention the importance of two classification cases which are now before the Custom's Court.

The tenth annual meeting of the association will be held at the Hotel Commodore in New York City on Thursday, December 10th.

Chromoxane Pure Blue BA

As a new brand manufactured by the General Aniline Works, the General Dyestuff Corporation as their sole selling agents, offer Chromoxane Pure Blue BA, which is principally recommended as a chrome-topped color but may also be used according to the chromate or chrome mordant method. It is said to produce bright blue shades of excellent fastness to fulling, potting, decatizing, washing and salt water. Chromoxane Pure Blue BA is also recommended by the manufacturer for vigoureux printing and for producing brilliant blue shades on silk.

Fastusol Blue 3R

The General Dyestuff Corporation releases Fastusol Blue 3R, a homogeneous direct dyestuff belonging to their class of fast-to-light colors. It is of particular interest that this color, next to its fastness to light, is also said to possess a remarkable fastness to water, perspiration and washing which is superior to that of any other direct blues.

N. C. State News

Mr. E. A. Terrell, president of the Terrell Machine Company of Charlotte, made the second of a series of semi-monthly addresses to be delivered before the Tompkins Textile Society of North Carolina State College by men prominently connected with the textile industry. He used as his topic "The Distribution of Textiles."

New Chromate Brown EB Conc.

A new type of this color has been introduced by John Campbell & Co. which can be dyed by the meta-chrome, chrome-botton and top-chrome methods, producing a deep nigger brown shade.

This color is said to possess excellent solubility and fastness to fulling, potting, washing, level dyeing and penetration.

An Introductory Study of Textile Microbiology—Chapter III

By **WILLIAM G. CHACE**

Instructor in Chemistry and Microbiology, Lowell Textile Institute

This is the third in a series of articles by the author on an introductory study of Textile Microbiology. These articles are intended to enable the textile chemist or other laboratory worker, not trained in microbiology, to undertake work in this field. The two previous installments appeared in the two issues of the AMERICAN DYESTUFF REPORTER immediately preceding this one.

THE investigator studying a case of damaged textile material will undoubtedly start with a microscopic examination of the material itself. This sort of examination will suffice if all that is desired is to find out whether the damage was due to the growth of mildew or to some other cause. Further study will require the use of the more intricate methods of study to be considered in detail later.

Two methods have been recommended for studying molds growing on cotton. These are the Cotton Blue method of Bright[17] and the Pianese IIIB stain recommended by Jennison[18]. For the other fibers no special methods have been devised, and a simple examination of the damaged material in a water mount* is the method in general use. In fact this method is probably the one most generally used for cotton.

The Cotton Blue method is carried out as follows: Warm the sample one minute in lacto-phenol medium made by mixing

Lactic acid (syrup)	2 parts
Phenol	2 parts
Glycerol	1 part
Distilled water	2 parts

Transfer to a 1% aqueous solution of Cotton Blue° and warm several minutes.

Wash in water and warm with lacto-phenol to remove as much color as possible. Mount in lacto-phenol or better in thick Canada balsam. The use of a yellow light filter such as the Wratten G filter improves the contrast. By this method, according to Bright, the mold is stained deep blue and the cotton practically unstained. The author has found it difficult, however, to attain this ideal differentiation, but the staining has the advantage of rendering readily visible the small and otherwise very transparent molds, even when it does not give a color difference between mold and cotton.

The Pianese procedure is carried out as follows: The sample to be stained is washed in water or alcohol, preferably the latter, and stained 15 to 45 minutes in a stain bath containing:

Martius Yellow C. I. No. 9	0.01 gm.
Malachite Green C. I. No. 657	0.50 gm.
Acid Fuchsin C. I. No. 692	0.10 gm.
Water	150 cc.
Alcohol	50 cc.

After removal from the stain bath, it is washed in water to remove excess stain and decolorized in acid alcohol. Jennison, in the original article, does not give directions for preparation of the acid alcohol but recommended[19] 1% hydrochloric acid.

A 1/2% solution of hydrochloric acid has given better results in this laboratory, and a 1% solution of acetic acid seems to have some advantages over the 1/2% hydrochloric although the differentiation is not as good. Jennison states that the mold is stained deep pink and the cotton green. Here again it has been the experience of the author that the ideal differentiation is rarely attained, but the staining of the mold greatly increases its visibility. The sample should be dried before examination and mounted in balsam or damar varnish. In view of the fact that neither of these more or less complicated methods gives a sure color difference all the time, the author has used a mixture originally recommended by Linder[20] and modified by Henrici[21] for staining molds on agar. It is prepared by adding 0.05 gm of Cotton Blue° (C. I. No. 707) to 100 gm of the lacto-phenol mixture mentioned above. The material to be examined is mounted and examined directly in this medium. The color of the medium is not deep enough to be noticeable in the thin layers used in mounting and a deep blue color is imparted to the material. No color differentiation is obtained by this method, of course, but it stains the molds so they may be easily observed. The difference in size between the molds and cotton hairs is so great that no difficulty is ever encountered. It is to be hoped that a satisfactory differential stain may sometime be worked

*Explanations of microscopic technique are omitted in these articles. See articles by Skinkle, this journal 19:410 and successive issues (1930) or "Elementary Textile Microscopy" by J. H. Skinkle, Howes Publishing Co., New York (1930).

°Colour Index numbers this stain 707. Since the names used by microscopists for stains, almost never tell us anything about the commercial dyes to use, and since for rough work commercial dyes are fairly satisfactory, the author has included after the name of each stain mentioned, the Colour Index number, in order that the textile worker may make use of such dyes as may be available. It should be pointed out, however, that for best results dyes of "stain" purity are necessary. The manufacturer's names for dyes with any particular Colour Index number may be found by referring to American Association of Textile Chemists and Colorists Yearbook.

out, but until it is, the very simple procedure given above seems the best all around method.

In cases where the material has been dyed, no staining method can be counted on to give predictable results and here again the simple mounting in lacto-phenol Cotton Blue solution has the advantage that it does not depend on the observation of any particular color.

No matter what method is used, very gentle handling is necessary as the molds are extremely delicate and are easily carried away by rough handling.

The appearance of mold hyphae in any of these methods is proof that the material has been mildewed, but the lack of such appearance is not proof that no microbiological attack has occurred, as the evidence may have been removed by some treatment or the action may have been caused by some organism which is not visible by the method employed, vis. bacteria. In some cases it is possible to identify the organism as an aspergillus, penicillium, or mucor but in most cases such identification is not possible. In case sufficient information is not given by this examination on the fiber, isolation in pure culture will be necessary. This will be described in a later number of this series. Figure 11 shows a mold growing on cotton.

Fig. 11

Mold on cotton fibres—mag. 100 *dia.*

While an examination on the fiber is very interesting and should never be omitted, it really shows only one thing: in cases where mold is found, that the stain was caused by mildew. Many times this is all that is required but more often it is required to know whether the growth has attacked the fiber or not. In any case where some of the unattacked material is available, recourse may be had to strengthen tests. These are in general, however, quite lengthy and difficult and do not really tell the whole story, as attack in the early stages does not affect the strength. It may easily affect the dyeing and finishing properties of the material though. A method is therefore desirable which will indicate whether the material is in the early stages of attack by micro-organisms. Two such methods have been devised for cotton. The Congo Red Test is described by Bright[21] as follows: 0.1 gm. of cotton is placed in 1 liter of water and suction is applied to withdraw air and insure thorough wetting out. The cotton is squeezed out and put in 2 5cc of exactly 11% sodium hydroxide solution. This mixture is shaken, allowed to stand 5 minutes, washed rapidly before placing in a saturated solution of Congo red (C. I. No. 370). In this solution it is shaken occasionally for 6 minutes, then removed and shaken with frequent changes of distilled water until the water is no longer colored. It is then mounted in an 18% solution of sodium hydroxide and examined. Normal fibers are stained light pink, damaged fibers take on a deep red at the points of damage.

Fig. 12

Normal cotton fibre after swelling—mag. 100 *dia.*

The second test is the Thaysen Swelling Test proposed by Fleming and Thaysen[22]. This is carried out by placing a small sample of the cotton under examination in 15% sodium hydroxide solution and an equal amount of carbon disulfide. The mixture is shaken frequently until the top layer is orange colored, about 10 minutes. The fibers are then removed and examined in a water mount. Normal fibers are swollen to a uniform bead-like appearance (see figure 12) while the damaged fibers lack the swellings in some portions and appear like figure 13. The greater the damage the fewer the swellings. In the author's experience this test is more satisfactory than the Congo red test, at least in the hands of inexperienced workers. Tests depending on differences in color depth always leave room for doubt in intermediate cases. The same view seems to be taken by Bright[21]. Both of these tests will show damage which cannot be detected by strength tests. Thaysen and Bunker claim to be able to distinguish between damage caused by micro-organisms and that caused by other agencies such as acids, abrasions, etc. Considerable experience with the test is necessary

before such differentiations can be made. These same authors describe a method by which quantative estimations of the damage may be made, but the procedure seems involved and doubt has been expressed as to its applicability.

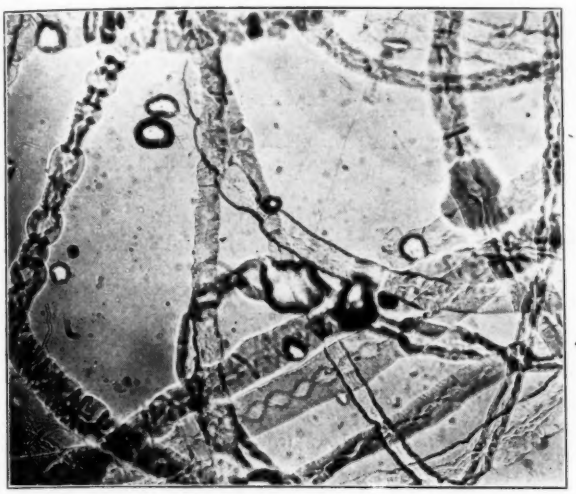


Fig. 13

Damaged cotton fibres after swelling—m.g. 100 dia.

The detection of damage in wool may be carried out by the Soundness Test of Rimington[23]. This test gives a quantitative determination of damage but as it detects all damage to the scales of the wool, no distinction can be made between microbiological and other types of damage. The following procedure is described by Rimington: "The reagent is prepared by mixing 10 cc of a 10% solution of sodium sulfanilate with 5 cc of an 8% solution of sodium nitrite then adding 2 cc of concentrated hydrochloric acid down the side of the vessel, mixing with a gentle motion and allowing to stand for one minute before use. A suitable quantity of the wool or cloth to be tested is weighted and then wetted out in 15 cc of a 9% solution of sodium carbonate; to this the reagent is added. After exactly 10 minutes the wool is withdrawn, rinsed thoroughly in water, and transferred to a test tube, 4 cc of a 10% solution of sodium hydroxide is added, the tube placed in a bath of boiling water for exactly 5 minutes, and the resulting reddish solution transferred quantitatively to a graduated volumetric flask and made up to volume.

"The weight of the wool taken and the final volume to which the solution is made depend upon the extent of the damage. Of cloth, a 0.1 gm sample is convenient to take with a final volume of 25 cc, but with sound loose wool 0.2 gm may be used and the final volume made up to 5, 10, or 15 cc.

"As a standard for comparison a 0.1% solution of New Acid Brown S is used."

Unfortunately the dyestuff mentioned, which is made by the British Dyestuffs Corp., is not listed in the Colour Index hence its American counterpart, if any, is not known to the author. This colorimetric method may be used where quantitative results are required but for qualitative work, examination before the wool is dissolved in sodium hydroxide is desirable. Where considerable damage has occurred locally, brown spots may be observed, indicating roughly by the depth of the color the extent of the damage. Where the damage is general, the darkening of the material as a whole gives a very rough indication of the damage, but as there is no standard of comparison in this case, little can be learned by naked eye examination. In this case, examination of the fibers under the microscope gives valuable information concerning the extent and type of the damage. Brown spots, of course, indicate places where injury has occurred. A method for carrying out a quantitative determination microscopically was described by Burgess and Rimington[24]. An interesting use for the test suggested by Rimington[23] is its use to detect susceptibility to microbiological attack. For this use it should be admirably suited as any damage to the scales would increase the ease with which micro-organisms could attack wool. The method cannot be used at all on wool that has been dyed.

No methods have been published for the detection of small amounts damaged to other fibers than cotton and wool. Where damage is suspected recourse will have to be had to strengthen tests.

One type of damage will not be detected by either of the above mentioned methods. This is the damage to material to be dyed, resulting from a fairly heavy growth of mold around the fibers. Materials which are sized, oiled, or treated with finishing compounds are often capable of supporting a luxurient growth of mold in which the fiber is not concerned, the organism obtaining its nourishment from the other substances present. The tests mentioned above will obviously not detect such damage as they depend upon some action on the fiber itself. Materials bearing growths of this kind are not suitable for dyeing, as the molds and fibers have very different dyeing properties, especially if the fiber is of animal origin, and attempts to dye such materials will result in very uneven dyeings, thus reducing the value of the product although the fibers themselves are unaltered. A careful microscopic examination should reveal this condition, however, if the dying process was not of such a nature as to so alter the shape of the mold threads as to render them unrecognizable.

References

2—Henrici, "Molds, Yeasts, and Actinomycetes." John Wiley and Sons, New York (1930).

17—Bright, J. Roy. Mic. Soc., 141 (1925).

18—Jennison, Science, 72:346 (1930).

19—Jennison, Private communication to the author.

20—Linder, Science, 70:430 (1929).

21—Bright, J. Text. Inst., 17:T396 (1926).

22—Fleming and Thaysen, Biochem. Jour. 14:25 (1920); ibid, 15.407 (1921).

23—Rimington, J. Text. Inst., 21:T237 (1930).

24—Burgess and Rimington, J. Roy. Misc. Soc., 49:341 (1929).

The Setting and Finishing of Worsteds*

THE question of setting a cloth satisfactorily is a very vital one in the treatment and finish of wool piece-goods. This applies more particularly to worsted material rather than to woolen goods. With the long fibered worsted cloths it is most important that a really good setting is given to the cloths before they are processed. With crossbreds, while it may be possible to process without a preliminary setting a grave risk may be attendant on such direct processing as dyeing and finishing without crabbing or other type of setting.

The finish of a cloth has, of course, to be carefully borne in mind when one is thinking of the kind of preparatory process to be given. Further, length of finished cloths is a vital matter nowadays, and one has not merely to give the requisite finish but frequently to attain a result where only an absolute minimum loss of length has taken place. Not only this but one has often to give grey weight, indeed sometimes more than grey. In other words, today the merchant not infrequently needs both the ha'penny and the toffee. After all, one should allow for the loss during scouring of anything up to a reasonable 3 or 4 per cent, oil, grease, dirt, etc.

All Important Factors

These factors naturally play a most important role in the finisher's mind as he considers the preliminary treatment he is to give to his cloths. It is almost a worn-out phrase to say that a cloth is either made or marred in the early processes, but there is no question about the truth of it. Quite apart, however, from the desired lengths and weights of cloths they must, in certain cases especially, be thoroughly set. If this is not done they may be absolutely ruined. Crimps and "cracks" would soon cause this. In order to set a cloth satisfactorily the commonest operation is that of crabbing. Now, quite apart from the setting of the cloth the crabbing gives a certain type of "finish" to the material, and if this type of finish is wanted, the crabbing thus serves two objects, that of supplying much towards the needed finish and also the setting of the cloth itself. In addition, in the type of cloths which are almost universally crabbed the crabbing operation will also aid, very often, in giving increased length, certainly greater than might be otherwise obtained. Further, in some cases the width of a cloth is a very vital factor and the economical merchant (or manufacturer) does not always give too generously in grey width, and the finisher's only weapon to give real permanence to the width is a crabbing or similar setting at the outset of processing.

Steaming

Sometimes crabbing in itself is not enough. Cloths may need something more than this. Some materials are very difficult indeed to set properly, especially when of very low quality and of long fiber, or in cases where warp and weft vary from each other to a marked extent in the quality of material. In such cases it may be necessary to "steam" after crabbing. This steaming is done by winding the pieces, at open width and perfectly straight, directly from the crab on to a perforated cylinder (a wrapper a few yards long being first wound on to the cylinder), and after the pieces have been run on, another wrapper is suitably wrapped round the pieces. Steam is then blown through the cylinder until it is seen to pass evenly through the pieces, the whole width of them, on the cylinder. Some refer to this steam setting operation as "wet-steaming." This type of setting is certainly more severe than mere crabbing.

It sometimes happens that cloths need a good setting, but it is not possible to accomplish this on the crab or by means of wet-steaming, because the cloth would suffer. One sees such cases as this in certain mixture or fancy cloths of the cheaper types, and generally, too, in the lighter weight varieties. For the sake of cheapness it has not been found possible perhaps to dye the yarn or the warp with the finest types of colors, or with such dyestuffs as would withstand the severe boil of the crab or of the wet steam referred to above. In such cases (and sometimes for other reasons too) the decatizing machine or "blower" will be found to be invaluable.

The decatizing machine is very similar in many ways to the perforated cylinder of the wet-steaming process. Steam is blown through the cylinder but the cloth is wound on to the cylinder previously along with a cotton wrapper of very fine texture (Venetian type of cloth), so that when the wrapper and cloth are on the machine the cloth is "sandwiched" inside the wrapper. A few yards of the wrapper are wound on to the cylinder before the cloth is started to be run on, and, in addition, there is always a number of yards of wrapper after all the cloth has been run on.

Steam is then blown through the perforated cylinder and the cloth until it issues evenly from along the whole length of the wrapper.

As a result of the steam being "dry," and the cloth never being moved in position while being treated, there is no bleeding of the dyestuff from the dyed yarns of

* Textile Mercury and Argus.

which the material is woven, such as would be the case if the setting were by means of the crab or wet-steaming. Whether the setting is by means of crabbing, etc., or decatizing the ultimate finish of the material will be seriously affected. It may be affected in such a way that the treatment is eminently satisfactory, or it may so affect the finish that the result is not wanted.

For example, crabbing certainly gives increased lustre to the cloths, and, in addition, sometimes gives a desirable "slip," which improves the handle of the goods. In the case of some cloths this "slip" and lustre must most decidedly be given and to as a great an extent as ever possible, and this may be achieved by means to be dealt with later.

NEW PATENTS

(*Abstracted by Synthetic Organic Chemical Mfrs. Assn.*)

Brown Vat Dyestuffs of the Anthraquinone Series. (Obtained by acting on a mercaptan compound of the anthracene series with an anthraquinone carboxylic acid and treating the anthrylthioanthraquinone-2-carboxylic acid thus formed with an acid condensing agent.) Werner Zerweck, of Frankfort-on-the-Main-Fechenheim, Ger., assignor to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,829,843, November 3, 1931.

Vat Dyestuffs of the N-Dihydro 1.2.2′:1′ *Anthraquinoneazine Series.* (Obtainable by oxidizing the products of the treatment of N-dihydro-1.2.2′.1′-anthraquinoneazines with formaldehyde in an acid medium, dyeing greenish blue shades by the action of aqueous potassium hydroxide solution.) Heinrich Neresheimer and Wilhelm Schneider, of Ludwigshafen-on-the-Rhine, Ger., assignors to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,830,852, November 10, 1931.

Indigoid Vat Dyestuffs and Process of Preparing Them. (Dyeing the fiber blue to greenish-blue tints and also suitable for calico printing, obtained by condensing an isatin-alpha-compound with a hydrovythionaphthene.) Karl Thiess and Theodor Meissner, of Frankfort-on-the-Main-Hochst, Ger., assignors to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,830,861, November 10, 1931.

Process of Preparing Dyestuffs and Intermediates from Benzanthrone Derivatives. (Consists in a process for the production of dibenzanthronyl bodies and hydroxy benzanthrone compounds from chloro substituted and methyl substituted benzanthrone, by treating these bodies in solution in sulphuric acid with manganese dioxide.) Robert Fraser Thomson and John Thomas, of Grangemouth, Scotland, assignor to Scottish Dyes, Ltd., of Grangemouth, Scotland, No. 1,831,691, November 10, 1931.

Vat Dyestuffs and Process of Making Same. (Obtained by treating the 2:2′-dibenzanthronyl in the presence of trichlorobenzene with ferric chloride, yielding on cotton pure navy blue shades fast to water.) Bertram Mayer and Hugo Siebenburger, of Basel, Switzerland, assignors to Society of Chemical Industry in Basle, of Basel, Switzerland, No. 1,831,715, November 10, 1931.

Vat-Dyestuffs of the Dibenzanthrone Series and Process of Making Same. (Produced by treating aminodibenzanthrones with an halogenated quinone of the benzene series, dyeing vegetable fiber deep green to blue-green tints of excellent fastness, particularly to chlorine.) Bertram Mayer and Hugo Siebenburger, of Basel, Switzerland, assignors to Firm Society of Chemical Industry in Basle, of Basel, Switzerland, No. 1,831,716, November 10, 1931.

New Monazodyestuffs. (For example, the ammonium salt of 4-nitro-1-amino-benzene-2-sulfonic acid is coupled with 2-isobutylamino-naphthalene-7-sulfonic acid and transformed into its sodium salt, dyeing wool from an acid bath even bluish violet shades of good fastness to washing, fulling and light, which can be discharged.) Winfrid Hentrich, of Wiesdorf-on-the-Rhine, and Rudolf Knoche, of Leverkusen-on-the-Rhine, Ger., assignors to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,823,939, September 22, 1931.

New Azodyestuffs and Process of Making Same. (4-amino-2′ .3′ .4′ .5′-tetrahydrodiphenyl is coupled with the sodium salt of 2-hydroxynaphthalene-7-sulfonic acid, dyeing wool from an acid bath yellow to red to violet to brownish shades of good fastness to washing and milling.) George Kalischer, of Frankfort-on-the-Main and Carl Schultis, of Frankfort-on-the-Main-Fechenheim, Ger., assignors to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,823,943, September 22, 1931.

Manufacture of Monazo-Dyestuffs. (For example, ortho-aminophenylortho-tolyl-ether is diazotized and coupled with 1-chloracetyl-amino-8-naphthol-3:6-disulphonic acid, dyeing wool and silk clear blue-red tint fast to light and fulling. Continuation of patent application Ser. No. 397,159, filed October 3, 1929.) Bernhard Richard, of Basel, Switzerland, assignor to J. R. Geigy, S. A., of Basel, Switzerland, No. 1,824,686, September 22, 1931.

Production of Blue Dyestuffs of the Halogenated Anthracene Series. (Comprises acting on impure N-dihydro-1, 2, 2′, 1′-anthraquinoneazine with sulphuric acid and manganese dioxide and treating the resulting product with a halogen hydride.) Paul Nawiasky and Artur Krause, of Ludwigshafen-on-the-Rhine, Ger., assignors to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,824,831, September 29, 1931.

Manufacture of Chromed Complexes of Azo and Ortho-Hydroxy-Azo Dyestuffs. (By treating the dyestuff with a chromium salt of an aromatic sulphonic acid of the group consisting of benzene and naphthalene mono- and polysulphonic acids.) Henry Mirocourt, of Sotteville-Lez-Rouen, France, assignor to Compagnie Nationale de Matieres Colorantes et Manufactures de Produits Chimiques du Nord Reunies, Etablissements Kuhlmann, of Paris, France, No. 1,824,914, September 29, 1931.

Vat Dyestuffs and Process of Preparing Them. (New vat dyestuffs dyeing different tints, obtainable by causing halogen dibenzpyrenquinones to act upon nitrogen-con-

taining compounds in the presence of a solvent.) George Kranzlein, Heinrich Vollmann, and Martin Corell, of Frankfort-on-the-Main-Hochst, Ger., assignors to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,825,740, October 6, 1931.

New Vat Dyestuffs. (Dyeing vegetable fibre from the vat currant to red-violet shades of excellent fastness, obtained by condensing 3.4.8.9-dibenzopyrene-5.10-quinone with alpha-aminoanthraquinone.) Max Albert Kunz, of Mannheim, and Karl Koeberle, of Ludwigshafen-on-the-Rhine, Ger., assignors to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,825,874, October 6, 1931.

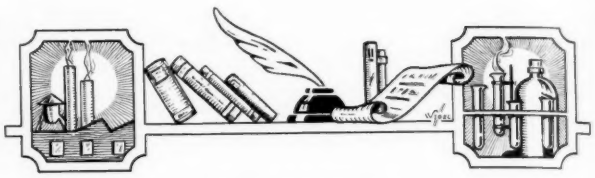
Vat Dyestuffs. (Dyeing vegetable fibre from the vat grey shades of excellent fastness, obtained by condensing 3.4.8.9-dibenzopyrene-5.10-quinone with 1-amino-4-benzoylamino anthroquinone.) Max Albert Kunz, of Mannheim, and Karl Koeberle, of Ludwigshafen-on-the-Rhine, Ger., assignors to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,825,875, October 6, 1931.

Sulphuric Acid Ester of the Leuco Compound of a Vat Dyestuff. (A new product the sulphuric acid ester of the leuco compound of 4:6-dichloro-6'-methoxy-bis-thionaphthene-indigo, said ester being in the form of its sodium salt a stable, white crystalline substance, readily soluble in water, yielding when printed or dyed on textile fibres and developed with acid oxidizing agents, very clear scarlet shades of good fastness properties.) Wilhelm Bauer and Ludwig Zeh, of Wiesdorf, Ger., assignors to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,826,720, October 13, 1931.

Indigoid Dyestuff. (The asymmetrical 4.6-dichloro-bis-thionaphthene indigo being a pink crystalline substance, scarcely soluble in organic solvents, difficulty soluble in sulfuric acid with a green coloration, yielding a yellow vat from which textile fibers after oxidation are dyed clear powerful ruby shades of excellent fastness properties.) Wilhelm Bauer and Ludwig Zeh, of Leverkusen-on-the-Rhine, Ger., assignors to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,826,721, October 13, 1931.

Reduction of Organic Carbonyl Compounds. (Comprises subjecting vat dyestuffs or an organic compound containing a reducible carbonyl group to the action of sulfurous acid and a metal in the presence of an organic base.) Eduard Muench, of Ludwigshafen-on-the-Rhine, Ger., and Theodor Voltz, of Basle, Switzerland, assignors to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,826,811, October 13, 1931.

Vat Dyestuffs of the Benzanthrone Series. (A process for the production of 6.6'-dichlor-dimethoxy-dibenzanthrone which comprises acting on a solution of 6.6'-dichlor-2.2'-dibenzanthronyl in concentrated sulfuric acid with manganese dioxide and subsequently methylating the reaction product. Cotton dyed yellowish green shades.) Arthur Luttringhaus and Hugo Wolff, of Mannheim, and Heinrich Neresheimer, of Ludwigshafen-on-the-Rhine, Ger., assignors to General Aniline Wks., Inc., of N. Y., N. Y., No. 1,827,295, October 13, 1931.



BOOK REVIEWS

Handbook of Chemistry and Physics (16th Edition), September, 1931. 1545 pages. Published by The Chemical Rubber Publishing Company, Cleveland, Ohio. Price $5.00 with special price to students in United States and Canada of $2.75. An extremely complete Handbook of Chemical and Physical tables, with the necessary accompanying Mathematical Data.

This the sixteenth edition, contains one hundred and eighty pages of new material. In addition about one hundred pages have been completely revised and many minor changes have been made throughout the book. Among the new tables are the following:

Abbreviations.
Characteristics of Vacuum Tubes.
Lowering of Freezing Point of Aqueous Solutions.
Natural Trigonometric Functions for Decimal Fractions of a Degree.
Physical Properties of Woods.
Reduction of Barometer Readings to Sea Level.
Persistent Lines of the Elements.
Comparison of Thermometer Scales.
Eight pages of explanatory matter on the use of Mathematical Tables.

The collection of units and conversion factors has been completely revised and very much extended. Changes in the accepted value of the atomic weight for several elements have necessitated extensive revision. The table of gravimetric factors has been completely recomputed and other tables, such as Physical Constants of Inorganic Compounds, Properties of Ceramic Raw Materials, involving molecular or atomic weights made to conform to the new values.

The following important sections are among those completely revised: Acceleration due to Gravity, Latitude, Longitude and Elevation, Integrals, Radioactivity, Surface Tension, Thermoelectric Power, Vapor Tension of Water above 100° C., Temperature Corrections for Barometric Readings.

Chemistry and Physics, always closely related sciences, have been brought into much more intimate relations by the more recent developments of research. To an increasing extent the student of either science should have a knowledge of the other. The present volume, which contains in a compact form the constants and formulæ of the two sciences together with all the mathematical and conversion tables necessary for accurate computations should find an important place in every chemist's and physicist's working equipment.

Theoretical and Applied Silk-Soaking

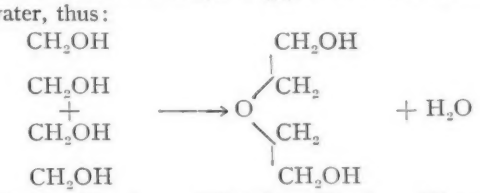
(Continued from Page 778)

ing of the threads upon drying. In working with yarns other than silk, in order to increase the tensile strength, it is customary to immerse them in a sizing bath to which a certain amount of a lubricant or softener is added. The softener in that case helps to overcome the harshness and brittleness of the dry size-film. Sericin may be considered a natural sizing and protective covering for the silk proper, but it lacks pliability when dry, whereas the softening oil, as in artificial sizing, overcomes this defect to some extent. It is to be noted, however, that excess softener is known to decrease the strength of artificial size-films; and therefore in the sizing of cotton warps, the amount of tallow for softening purposes is usually limited to 5% of the starch. Furthermore, besides giving rise to oil-soaking cones, excess softener may also exert a waterproofing tendency, interfering with the proper absorption of moisture by the yarn prior to knitting.

Unprocessed oils commonly used for soaking are neatsfoot, olive and mineral oils of the stainless, fully-refined grade. Neatsfoot oil, containing 2 to 5% free fatty acids and with a low cold test, seems to be used more than any of the others. The amount of oil generally employed varies from 6 to 12 pounds per 100 pounds of raw stock from 1 to 2½% in concentration. There is some uncertainty about the use of mineral oil in the soaking bath. B. Levitt believes that a mineral oil of the proper quality is not detrimental in silk processing, and claims that at least 75% of hosiery tram is being processed with a lubricant containing high grade mineral oil and that the use of such oil is constantly increasing. Another writer states that "a neatsfoot oil compounded with about 30% of mineral oil will give better results than straight neatsfoot oil." Undoubtedly mineral oils are superior not only in lubricating properties but also in that they tend the least to oxidize, gum, or turn rancid. Objections to their use centers mainly around the alleged difficulty of their complete removal in later processes. It is said, however, that white mineral oil in addition to other saponifiable oils, when compounded with about 6% free fatty acids, is readily removed from the fabric during degumming. The successful use of mineral oils and for that matter also saponifiable oils seems to be a question of properly formulating the soaking bath and adjusting the conditions during boiling-off for the satisfactory removal of the oil.

Diethylene Glycol as Softener

Diethylene glycol has been recommended for lubricating, softening, and particularly for increasing the hygroscopic properties of the yarn. Diethylene glycol is a colorless, odorless, mobile liquid boiling at 244.5° C., miscible with water in all proportions, and in many respects resembling glycerol, though not so viscous. Chemically it is a hydroxyether, obtained by the condensation of two molecules of ethylene glycol with the elimination of water, thus:

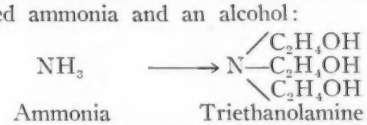


Tthylene Glycol Diethylene Glycol Water

According to H. D. Harvey, Jr., diethylene glycol and glycerol absorb about equal maximum amounts of water, but the former under the proper conditions will gain or lose its moisture more rapidly. Enoch Swan reports that glycerol at 68° F. and 80% relative humidity takes up 90.5% of water. It is therefore probable that such substances, even under very favorable conditions of humidity and temperature, do not increase the moisture content of the yarn by more than their own weight. Cost and other considerations usually limit the quantity of diethylene glycol to a maximum of 2 to 3% on the weight of the yarn. Hence, it can be responsible only for an additional 2 to 3% moisture on the fiber, compared with 50% which according to D. S. Chamberlin is obtained after back-winding. Because of the insolubility of sericin in diethylene glycol, the direct softening and plasticizing of the yarn is doubtful. As a lubricant it has the advantage over oil in its solubility in water, though of course it does not equal it in lubricity. Harvey states that diethylene glycol by itself is not a softener, but being a strong penetrant and possessing the ability to carry softening oils and fats into the fibers, there is a decided softness obtained, which is further increased by the hygroscopicity of the diethylene glycol.

Triethanolamine as Emulsifying Agent

Triethanolamine is a mild organic base, and in combination with fatty acids, has proved to be a very valuable emulsifying agent for oils. It is a viscous, hygroscopic, nearly odorless liquid, with a slight yellow color, boiling at 277° C. at 150 mm. Triethanolamine chemically is a substituted ammonia and an alcohol:



Ammonia Triethanolamine

It is soluble in water and in alcohol but only slightly in oils, unless in combination with fatty acids. Its average combining weight with the latter is about 2½ times that of caustic potash, so that about 50% triethanolamine is required for the complete neutralization of fatty acids.

As a rule the more stable oil emulsions are obtained with approximately equal amounts of triethanolamine soap and free fatty acids. The oleate, it is claimed, has a pH of about 8.6 compared with 10.2 for the corresponding soda or potash soap. Triethanolamine itself has a pH of 10.2, which is about 1/6 the alkalinity of ammonia.

(To Be Continued in Next Issue)

Acid Anthracene Red 3B

This gives a blue shade and is said to be an exceptionally good color for dyeing piece goods. It can be used for shading chrome colors, either top-chrome or chrome-bottom. Neutral dyeing properties and use as a shading agent for coloring of animal fibers are also claimed. Vegetable fibers are claimed to be left practically white. It is recommended by John Campbell & Co. to be dyed with Glauber's salt and acetic acid, which exhausts the bath and brightens the shade.

North Carolina State College Adds New Textile Equipment

John T. Hilton, Associate Professor of Yarn Manufacturing, said today that the Textile School of North Carolina State College now has one of the best equipped laboratories in America for conducting spinning tests, as it has just completed the installation of a Howard and Bullough spinning frame fitted up with the High Roller Draft system of long draft spinning, recently developed by this company. Power for this frame is supplied by a Reeves Variable Speed Drive with which it is possible to secure spindle speeds ranging from 8,000 to 14,000 revolutions per minute. This is said to be a new development, as it is probably the first time that a Reeves Drive has been applied to a spinning frame.

Spring Silk Colors

Seventy-eight shades will appear on the 1932 Spring Season Card to be issued shortly by the Textile Color Card Association. The confidential advance edition has just been sent out to members, it was announced recently by Margaret Hayden Rorke, managing director.

Blues are highlighted on the new card in bright medium tones with a slight purplish cast, marine and light navy shades reflecting the nautical influence, and deep azure tones with a hint of violet.

Significant as a high style note are the new light beiges in the shell and bisque tints. Creamy champagne tones shading into light mocha represent another smart range. Spring browns are interpreted in a new gamme of creamy chocolate shades.

Reds, which occupied a strong position at the recent Paris openings, are shown in brilliant yellowish or orange hues and bright apple red. New Spring developments of copper and rust are supplemented by subtle peach-apricot tones of coppery cast.

Lively shades of yellowish green continue their popularity. The newest rendition of this color family, however, is a light olive-tinted range. Soft jade tones, like those reflected in Chinese pottery, constitute another favored version of green.

Another new color note portrayed on the card comprises a range of deep rich pinks shading into cherry rose. Lighter Spring renditions of grey are represented in clear pastel and medium tones. A range of three purple shades reflects a bluish cast.

Greece Has Small Dyestuff Industry

Greek production of organic dyestuffs amounted to 267,597 pounds in 1930, falling slightly below the 1929 output of 269,948 pounds. (From the consulate general, Athens.)

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

POSITION WANTED

DYER—Six years' experience at bleaching and dyeing wool, cotton, jute and union raw stocks and yarns. Thoroughly experienced in all stages of carpet manufacture. Age, 26; married. Address: Classified Box No. 692, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

CENTRAL EUROPE

Responsible Party (Active Member AATCC) planning three or four months' trip to Central Europe will consider making investigations, securing business connections or doing similar work for part of expenses. Address Box No. 704, American Dyestuff Reporter, 440 Fourth Avenue, New York, N. Y.

POSITION WANTED

Chemical engineer, age 27, four years in large silk dyehouse, assistant superintendent dyeing, weighting of skein and piece goods. Desires connection with dyehouse or chemical manufacturing plant. Address Box No. 707, American Dyestuff Reporter, 440 Fourth Avenue, New York, N. Y.

POSITION WANTED

RAYON AND COTTON DYER—Skein dyer, all types of dyes. Ten years' thorough experience. Technical college graduate. Perfect matches. Reasonable salary. Address Box No. 708, American Dyestuff Reporter, 440 Fourth Avenue, New York, N. Y.

POSITION WANTED

Salesman of chemicals, oils and dyestuffs, formerly connected with large manufacturer, is open for sales position. Have established trade and can give very satisfactory references. Apply Box No. 709, American Dyestuff Reporter, 440 Fourth Avenue, New York, N. Y.